October 19, 2018

TO: Transportation, Energy, and Utilities Committee

FROM: Nicole Losch, PTP, Senior Planner

RE: Main Street / Winooski River Bridge Scoping Report

Recommendation

We respectfully request that the Transportation, Energy, and Utilities Committee approve the following motion:

To accept the Winooski River Bridge Scoping Report and endorse the Advisory Committee's selection of Alternatives 4 and 5 as the preferred alternatives to move forward using an accelerated bridge construction approach; and to recommend that the City Council accept and endorse the same through Resolution.

Summary

The City of Burlington has partnered with the City of Winooski and the Chittenden County Regional Planning Commission to complete a scoping study of the Main Street / Winooski River bridge. The scoping study was led by McFarland Johnson and was advanced with the support of a local Advisory Committee. The purpose of this Scoping Report was to develop alternatives for the improvements to the Main Street / Winooski River Bridge connecting the Cities of Burlington and Winooski. Through public meetings, State agency meetings, and Advisory Committee meetings:

- Alternatives 4 and 5 were selected as the preferred alternative,
- The future roadway width of the bridge would be 52' (four 11' travel lanes with 2' shoulders),
- The future pedestrian and bicycle accommodations would include protected 12' shared-use paths on each side of the bridge,
- The method of construction would be accelerated bridge construction,
- The traffic accommodations during construction would require an offsite detour only while the bridge is closed, and
- The cost estimate is $18.3 - $22.7 million

Lastly, Alternatives 4 and 5 do not preclude future reconstruction of the Colchester Avenue/Riverside Avenue intersection or other future projects in the nearby vicinity.

The Winooski City Council considered this item at their October meeting and support the Advisory Committee's recommendation.

Next Steps

At the Transportation, Energy, and Utilities Committee (TEUC) meeting, we will provide a brief presentation and summary of the Scoping process and outcomes. The final draft report is included in this packet and the Appendices will be available on the project website:
https://www.ccrpcvt.org/our-work/transportation/current-projects/scoping/winooski-river-bridge-scoping-study/

Following the TEUC's consideration and approval, this will be presented to the full City Council at an upcoming meeting suggested by the TEUC.

Thank you for your consideration of this request. Please don't hesitate to contact me with any questions.

CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION

DRAFT SCOPING REPORT

FOR

MAIN STREET BRIDGE (US ROUTES 2 & 7) OVER THE WINOOSKI RIVER

CHITTENDEN COUNTY RPC
Communities Planning Together

McFarland Johnson

October 8, 2018

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I. EXECUTIVE SUMMARY

The purpose of this Scoping Report was to develop alternatives for the improvements to the Main Street Bridge connecting the Cities of Burlington and Winooski, VT over the Winooski River. The conclusion and recommendations outlined in this Scoping Report have been developed through coordination with the Chittenden County Regional Planning Commission, an Advisory Committee comprised of project stakeholders and local leaders, and public input. The development and review of this study is outlined in this report, and an executive summary is provided below.

- Preferred Alternative .... Alternative 4 & Alternative 5
- Roadway Width .... 52' (four 11' Lanes with two 2' Shoulders)
- Pedestrian/Bike Accommodation .... Protected Multi-Use Path on Each Side of the Bridge Which Tie-In to Existing Sidewalks
- Traffic Accommodation.................. Offsite Detour During Bridge Closure
- Method of Construction.................. Accelerated Bridge Construction
- Estimated Project Cost.................... $18.3 Million (Alternative 4), $22.7 Million (Alternative 5)

Both Alternative 4 & 5 do not preclude future reconstruction projects of the Colchester Avenue/Riverside Avenue intersection re-configuration project or other future projects in the nearby vicinity.

II. INTRODUCTION

The Chittenden County Regional Planning Commission (CCRPC) requested the services of McFarland Johnson Inc. (MJ) to develop a scoping study for the improvement of the bridge carrying Main Street and US Route 2 & 7 over the Winooski River. This Scoping Report identifies the short- and long-term needs of the bridge, traveling public and resource agencies, and develops alternatives to address the stakeholder concerns. A recommended alternative is then presented to the City Councils of both Burlington and Winooski for approval of the final Scoping Report.

The scoping process includes developing and working in conjunction with a project advisory committee made of community leaders, City of Burlington and Winooski staff, CCRPC staff and neighborhood representatives. Advisory Committee members for this project are listed below:

Jon Griffin ....VTrans
Dick Hosking ....VTrans
Amy Bell ....VTrans
Peter Wernsdorfer ....Winooski
Jon Rauscher... Winooski
Heather Carrington................................ Winooski
Ryan Lambert ....Winooski
Nicole Losch ....Burlington
Sharon Bushor ....Burlington City Council
Richard Deane.. Burlington City Council
Dave Armstrong ....GMT

Rachel Kennedy.....................................GMT
Sandy Thibault.......................................CATMA
Katelin Brewer-Colie ....Local Motion
Allegra Williams ....Local Motion
David Keelty ....UVM Medical Center
Richard Hillyard.....................................Burlington Ward 1 NPA
Wayne Senville......................................Alternate for Ward 1
Eleni Churchill ....CCRPC
Peter Keating...CCRPC
Marshall Distell ....CCRPC
Jason Charest ....CCRPC

The advisory committee assisted the CCRPC & MJ staff in reviewing and developing alternatives and recommending a preferred alternative.

III. PROJECT BACKGROUND

The Main Street Bridge carrying US Route 2 and 7 over the Winooski River is a principal arterial structure which carries approximately 25,000 vehicles per day between the cities of Burlington and Winooski, Vermont. The existing structure, constructed in 1929, is a 3-span steel multi-girder system supported by reinforced concrete abutments and piers which are founded on bedrock.

The Main Street Bridge is the only crossing over the Winooski River that connects the downtown communities of two of Vermont's most densely populated cities: Burlington and Winooski. As the bridge approaches the end of its service life, it has become apparent that it no longer meets the needs of the communities it serves. The existing structure features narrow vehicle travel lanes, no shoulders, and narrow sidewalks. There is no buffer separating vehicular traffic from pedestrians and bicyclists, creating unsafe conditions for all travelers. Due to the urban environment and existing infrastructure, improvements to the Main Street Bridge have become a priority to the ongoing initiatives to improve connectivity and safety for multi-modal transportation in the region.

This scoping study builds upon the recommendations outlined in the documents below to develop a preferred alternative which addresses the needs of the existing bridge, while accommodating the future needs of the surrounding area. The reports that have been reviewed and incorporated are:

- Colchester Riverside Avenue Scoping Report (2018)
- Winooski River Bicycle & Pedestrian Bridge (2017)
- Winooski Main Street Corridor Plan (2014)
- Load Rating Report (2012)

The study area for the bridge was determined at the early outset of the project and is summarized in Figure 2. **Error! Reference source not found.** shows a broader overview of the region with the project location denoted by a star. Note the limited alternate crossing locations over the Winooski River. The study area that was used for the bridge study differs in size from the resource impact study area, since the resource identification typically takes a larger view to ensure there will not be impacts beyond the bridge study area.

Figure 1: Regional Project Study Area

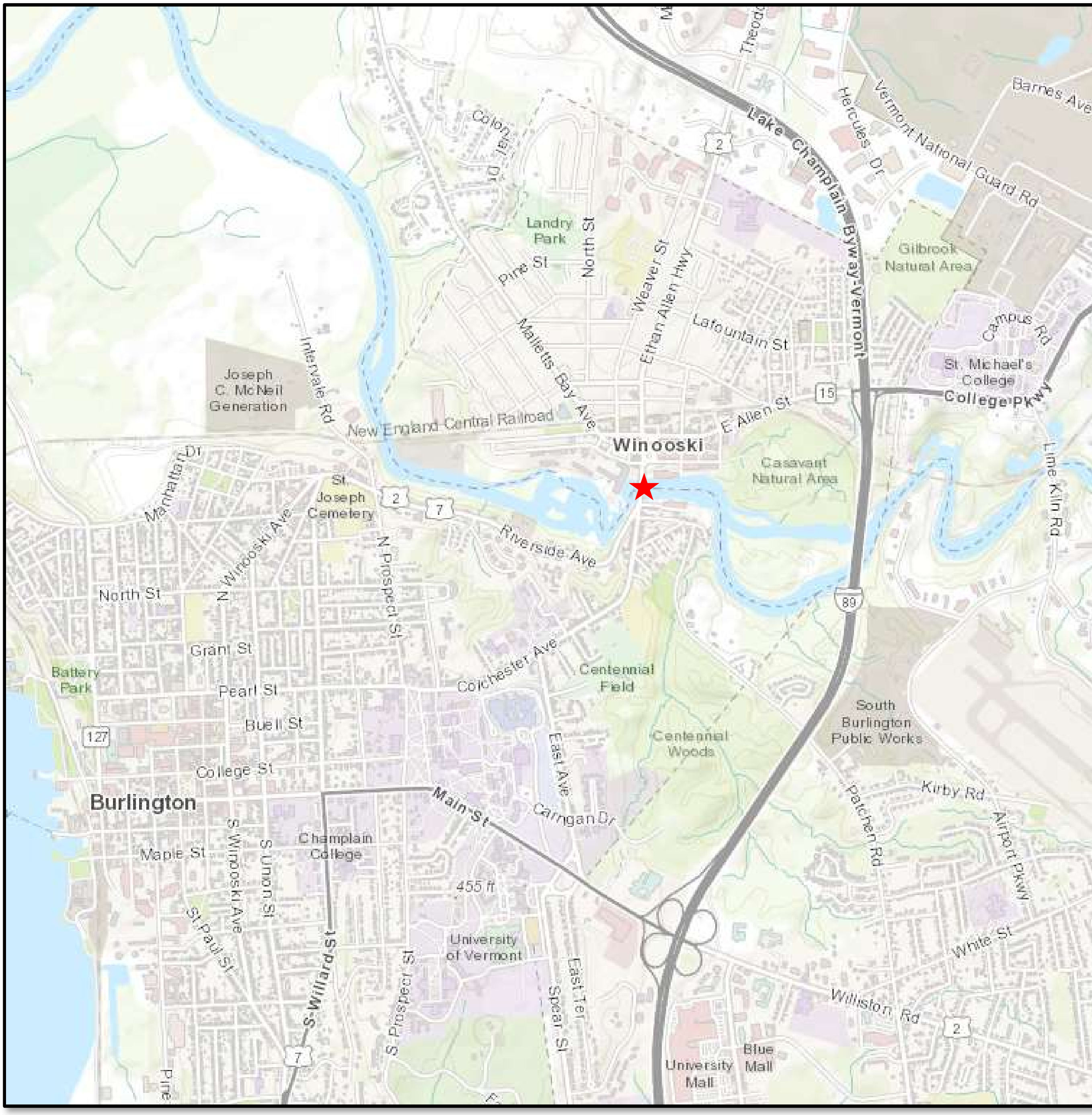
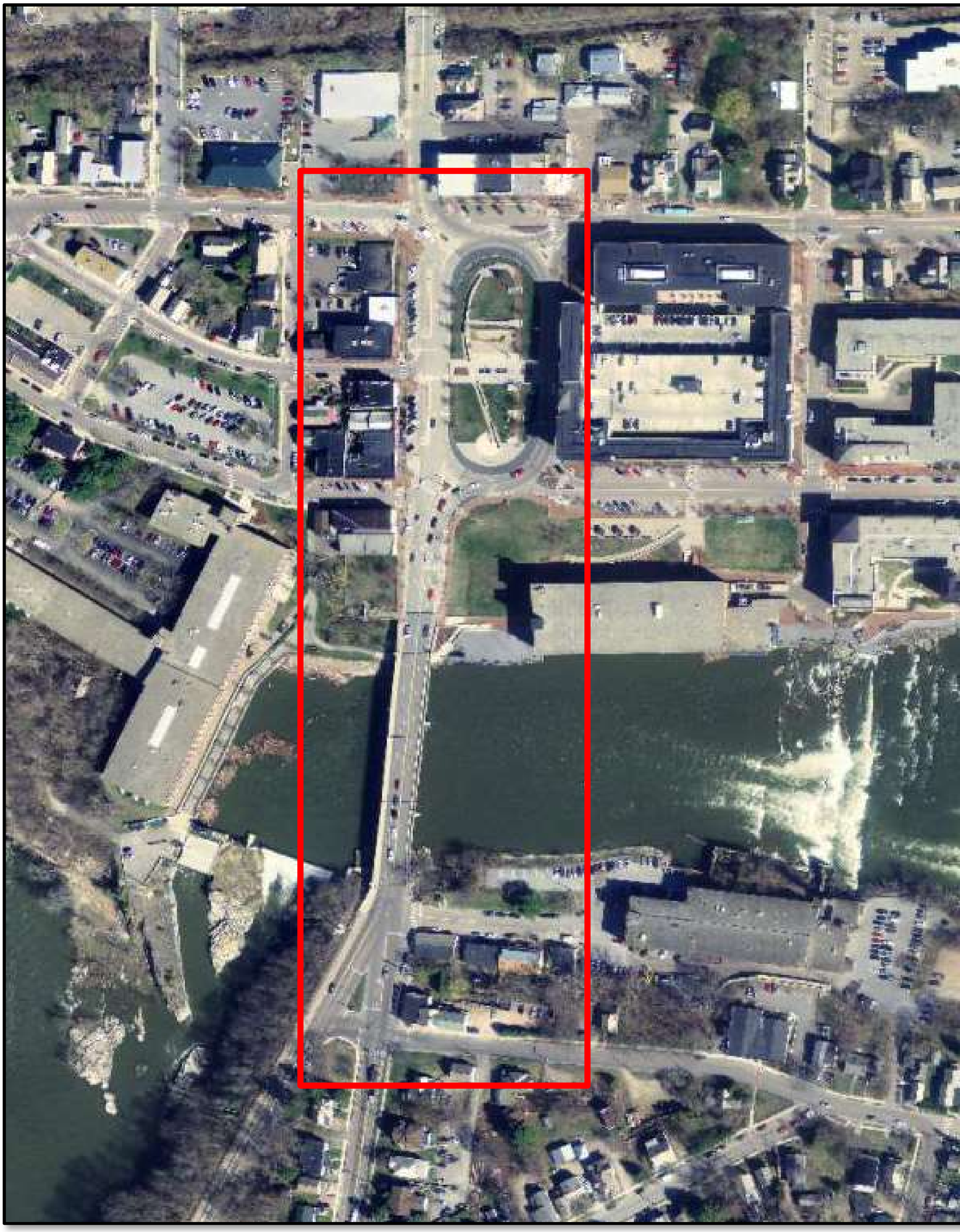


Figure 2: Project Study Area



PURPOSE AND NEED

A responsibility of the Advisory Committee, in conjunction with the CCRPC, during the initial phases of the study was to develop a Purpose and Need statement to define the objective of the Scoping Report. The purpose and needs for this Scoping Report are developed upon the different aspects and perspectives of the community, which are represented through the Advisory Committee. The following purpose statement was developed:

Purpose:

The purpose of the project is to improve safety while maintaining structural integrity and continuity of this integral link between Winooski and Burlington across the Winooski River. The project will address deficiencies in the bridge while improving multi-modal (bike, pedestrian, vehicular) travel for people and goods. Project recommendations will also complement the context of the natural and cultural environment and provide an aesthetically appealing bridge structure(s) to link the two Cities.

Need:

The project needs that were identified by the Advisory Committee define the guidelines for evaluating the alternatives that are developed. The following needs were identified and used as a guideline for the alternative evaluation:

1. Provide designated lanes for bicyclists:
   - The lack of bicycle lanes on the bridge leads to bicyclists riding on the sidewalk creating an unsafe condition for both bicyclists and pedestrians.
2. Provide two lanes of traffic in both direction:
   - The high traffic demand on the crossing requires two lanes of traffic in both directions to minimize delay and queuing of traffic across the bridge and through the Winooski and Burlington intersections at either end.

3. Improve safety for pedestrians:
   - The lack of shoulders produces an unsafe feeling for pedestrians given the close proximity to the vehicular travel way.
   - The bridge rail is also below standard height for a pedestrian rail.

4. Address the conditional deficiencies of this aging bridge structure:
   - The bridge, originally constructed in 1929, is in the latter stage of its design service life.
   - The bridge deck, rated in satisfactory condition, has isolated areas of concrete spalling and delamination that need patching, repair, or partial replacement.
   - Significant portions of the concrete bridge railing are in poor condition and require immediate repair and replacement. In addition, the historic rail was not designed to current structural design code standards.
   - The structural steel superstructure, rated in satisfactory condition, has isolated areas requiring repair, cleaning and painting.
   - The concrete sidewalks and curbs require cleaning, patching and repair to address spalls and cracks to its top and vertical surfaces.

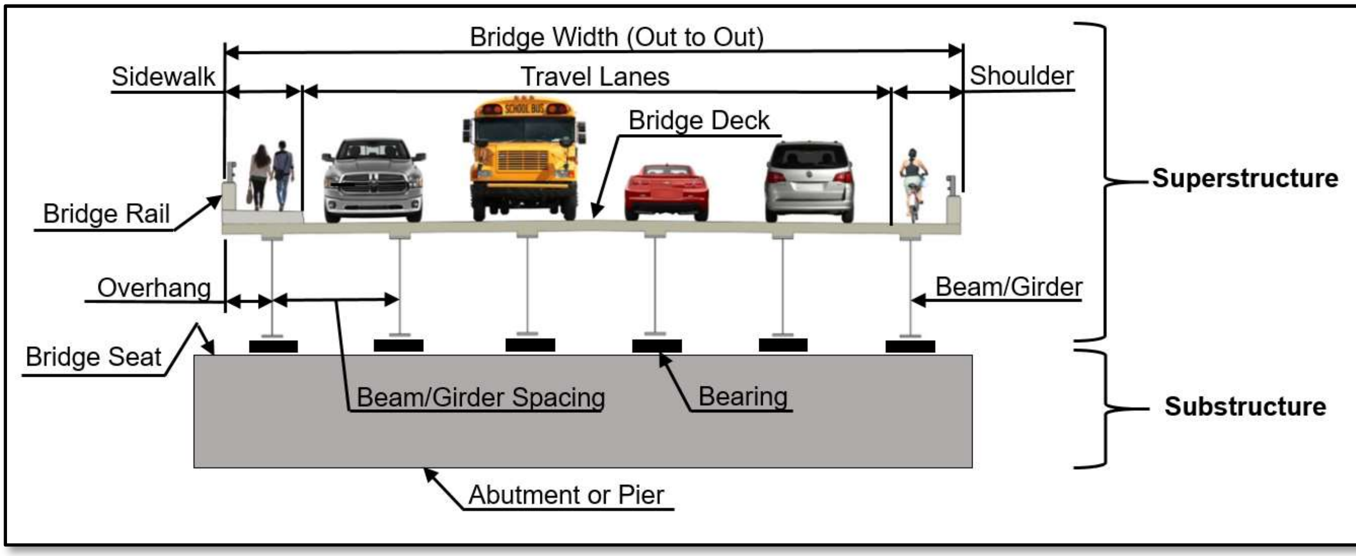
- The concrete substructure piers and abutments, rated in good condition, have minimal need of patching and repair.

This Purpose and Need statement was presented at a public meeting and comments received were incorporated into the final version.

IV. TYPICAL BRIDGE SECTION DESCRIPTION

Various components of a bridge and its individual components will be referenced throughout this report. A sample typical bridge section is provided in Figure 3, with callouts defining the standard components of a bridge.

Figure 3 - Typical Bridge Section Definitions



V. EXISTING SITE INFORMATION

TRAFFIC

The Main Street Bridge experiences relatively heavy traffic with an average volume of traffic of over 25,000 vehicles per day. The high volume of traffic is a result of the roadway being an important connection between Burlington and Winooski and one of the few Winooski River crossings in the area. Traffic crossing the bridge experiences travel delay, especially during the morning and afternoon peak periods, but the delay is mainly attributed to the intersections immediately adjacent the bridge in both Burlington and Winooski.

Table 1 below summarizes the traffic data for the Main Street Bridge. Traffic counts were obtained from the Vermont Agency of Transportation's (VTrans) Transportation Management System count location D039, located at the North end of the bridge. The traffic volumes are projected to the years 2018 and 2038. The estimated percent truck value is based on the 2016 Functional Class Averages from the VTrans 2016 Automatic Vehicle Classification Report. The percent directional (%D) was calculated by averaging the %D for the AM and PM existing conditions peak hour model results from "Burlington and Winooski US-2/7 Bridge Traffic Assessment Model Documentation and Results", which was prepared by Resource Systems Group, Inc. (RSG) in 2017 for CCRPC (see Appendix G). Peak traffic flows are heading Southbound in the AM and Northbound in the PM.

Table 1 - Traffic Summary

US ROUTE 7 – Main Street		
TRAFFIC DATA	**2018**	**2038**
Annual Average Daily Traffic (AADT)	25,400 Vehicles per Day	27,700 Vehicles per Day
Design Hourly Volume (DHV)	2,286 Vehicles per Hour	2,493 Vehicles per Hour
% Trucks (%T)	7%	7%
% Directional (%D)	57% (SB in AM, NB in PM)	57% (SB in AM, NB in PM)

ROADWAY DESIGN CRITERIA

Minimum roadway design criteria this bridge project are taken from the Vermont State Standards, dated October 22, 1997 are based on an ADT > 2000 and a design speed of 25 mph. These criteria have been established to provide a baseline for safety and accommodations for vehicles, bicycles, and pedestrians. Providing elements that do not meet the minimum standard could result in an increased number of crashes or different modes of transportation needing to use the same space. For instance, with substandard shoulder widths, bicyclists do not have their own dedicated space and so they either must share the lane with vehicles or ride on the sidewalk with pedestrians.

Table 2 - Roadway Design Criteria Summary

Design Criteria	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	11'/Varies (2'min) (48')	11'/4' (52')	***Substandard***
Bridge Lane and Shoulder Widths	10.5'/0' (42')	11'/5' (54')	***Substandard***
Speed	25 mph (Posted)	25	
Horizontal Alignment	Bridge and Approaches on Tangent	R_{min} = 134' @ 8.0%	
Vertical Grade	1%	9% Max	
K Values for Vertical Curves	K_{Crest} = 50	20 Crest / 30 Sag	
Stopping Sight Distance	Greater than Required	150	
Bicycle/Pedestrian Criteria	2' min on approaches 0' on bridge	4' on approach 5' on bridge	***Substandard on Bridge Approaches***
Bridge Railing (and Approach Railing)	Historic Railing	MASH Compliant TL-2 Railing w/Pedestrian Railing	***Substandard on Bridge and Approaches***
Sidewalk Width	6'	5'	

EXISTING BRIDGE INSPECTION REPORT SUMMARY

VTrans inspects all bridges every two years in accordance with the National Bridge Inspection Standards (NBIS). The information gathered during an inspection is summarized in a Structure Inventory and Appraisal (SIA) sheet, which then helps agencies determine bridge safety and required maintenance work. A summary of the condition rating of the Main Street Bridge based on the 2017 SIA report is summarized below:

Deck Rating ....6 (Out of 9, Satisfactory Condition)

Superstructure Rating ....6 (Out of 9, Satisfactory Condition)

Substructure Rating ....7 (Out of 9, Good Condition)

Channel Rating ....8 (Out of 9, Very Good Condition)

Sufficiency Rating...65.3 (Out of 100)

Deficiency Status..Functionally Deficient (i.e. the existing bridge does not meet current functional design criteria)

The bridge has been determined to be functionally deficient because it does not provide the minimum required shoulder width.

The inspection summary provided below summarizes the findings of the 2017 Inspection Report

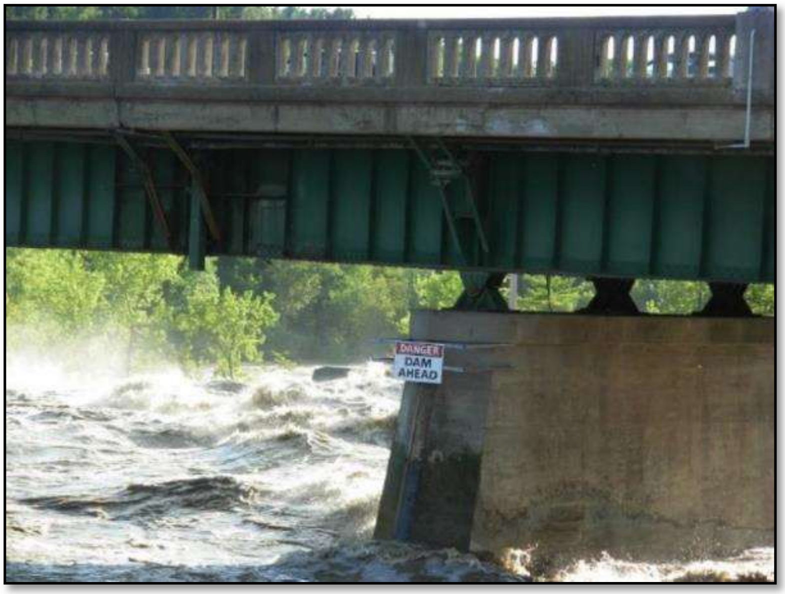
> *05/24/2017 – Structure is in fair to good condition. Damaged rail on the upstream side has been repaired. Sidewalk has areas of spalling that should be cleaned and patched. Beams should be spot cleaned and painted. Spalling in the spindles in the rail on the upstream side should be repaired. ~FRE/JAS/MC*

In addition to the condition ratings noted above, steel coupon sample testing was performed as part of the load rating report in 2012. Steel coupon sample testing is performed by removing 2”x6” pieces of steel from non-critical areas of the bridge and performing strength tests on the sample to determine its material properties. These tests are conducted so that actual material strength properties can be used for evaluating the capacity of the bridge. The results of the steel coupon sample testing showed that the steel strength is within the expected strength range for structures constructed during that time-frame. This indicates that the assumptions made during the load rating process were accurate, and that there are no immediate concerns with the capacity of the bridge in its current condition.

HYDRAULICS

The existing bridge structure bottom of steel low point elevation sits approximately 8’ above the 100-year storm elevation. The Winooski river upstream and downstream of the existing structure is dam controlled, and therefore the probability of floodwater encroachment on the bottom of the steel beams is considered remote. The current bridge design criteria require a minimum of 1’ of clearance between the steel low point and the water surface elevation of the 100-year storm. Any future bridge replacement will meet or exceed the existing low chord elevation. Figure 4 below shows the bridge during the extreme flooding from Hurricane Irene in 2011; note the bridge has substantial clearance above the flood waters.

Figure 4 - Hurricane Irene (August 2011) Below the Existing Bridge



UTILITIES

The following utilities are currently located on the bridge:

- Telecommunications

In addition to the utilities located on the bridge, overhead and buried utilities are located in both approach roadways. A summary of the utilities located in the south (City of Burlington) approach roadway are:

- Electric Lines (Unknown size conduits)
- Water Mains (Unknown size)
- Gas Lines (Unknown size)

Utilities under or above the approach roadway may require to be relocated during construction to allow for equipment access or for necessary excavation. At the time of this study, the owners of all utilities were not known. Further coordination with utility companies will be required during the design phase of the chosen alternative.

RESOURCES

A preliminary review of the natural resources present within and near the project study area was performed at the start of development of the Scoping Report. As part of the investigation, the following resources were identified and characterized:

- Wetlands & Surface Waters
- Floodplains and Floodways
- Hazardous Materials Sites
- Habitat & Wildlife Corridors

- Rare, Threatened and Endangered Species
- Conservation & Recreation Lands
- Historic & Archaeological Sites

Refer to Appendix F for a complete summary of the study's findings.

Wetlands & Surface Waters

The study investigated impacts to any wetlands or surface waters within the project area. There are no Vermont Significant Wetland Inventory (VSWI) wetlands within the project study area. The Winooski River is the only surface water within the project area. Temporary impacts to the Winooski River will be necessary for any improvements to the Main Street Bridge. A summary of the wetlands and surface waters is shown in Figure 5 below:

Floodplains and Floodways

The study identified the floodplains and regulatory floodways of the Winooski River using information from the Federal Emergency Management Agency (FEMA). The alternatives proposed in this scoping study will have no permanent negative impacts to the floodplain. See Figure 6 below for a map showing floodplains and floodways in the project area.

Hazardous Materials Sites

The resource study identified one low potential hazardous material site within the vicinity of the bridge. This site is located east of the north approach in Winooski Falls Way, circled in yellow in Figure 7 below, and "has known petroleum contamination." This location could be impacted by construction activities.

Habitat Blocks & Wildlife Corridors

It is important to consider a project's potential disturbances to wildlife habitats in the surrounding area. Based on the study's findings, due to the urban environment surrounding the Main Street Bridge, there are no habitat blocks or wildlife corridors within the project study area, shown in Figure 8 below.

Rare, Threatened & Endangered Species

The resource study examined potential impacts to rare, threatened, and endangered species located in the project area. Based on the study's findings, there are no rare, threatened or endangered species within the immediate vicinity of the Main Street Bridge. There are several downstream of the hydroelectric dam, but they are located outside the project study area and will not be impacted. See Figure 9 for more details.

Conservation & Recreation Lands

The resource study identified two potential areas where impacts to conservation and recreation land may occur, both on the north (Winooski) side of the bridge and are noted in Figure 10. Falls Terrace Park and Riverfront Park may be impacted due to construction activities of the preferred alternative, and therefore will require Section 4(f) evaluation. Per the guidance of the Federal Highway Administration (FHWA), the purpose of Section 4(f) evaluation is to verify that "there is no feasible and prudent avoidance alternative to the use of land; and the action includes all possible planning to minimize harm to the property resulting from such use."

Historic & Archaeological Identification

Due to the notable history of the surrounding area, it is important that any disturbance to historically significant areas or structures are minimized. Based on the study's findings, there is one potential area where impacts to potentially historic or archaeologically sensitive land may occur, on the northwest (Winooski) side of the bridge at Falls Terrace Park.

Figure 5 - Wetlands and Surface Waters

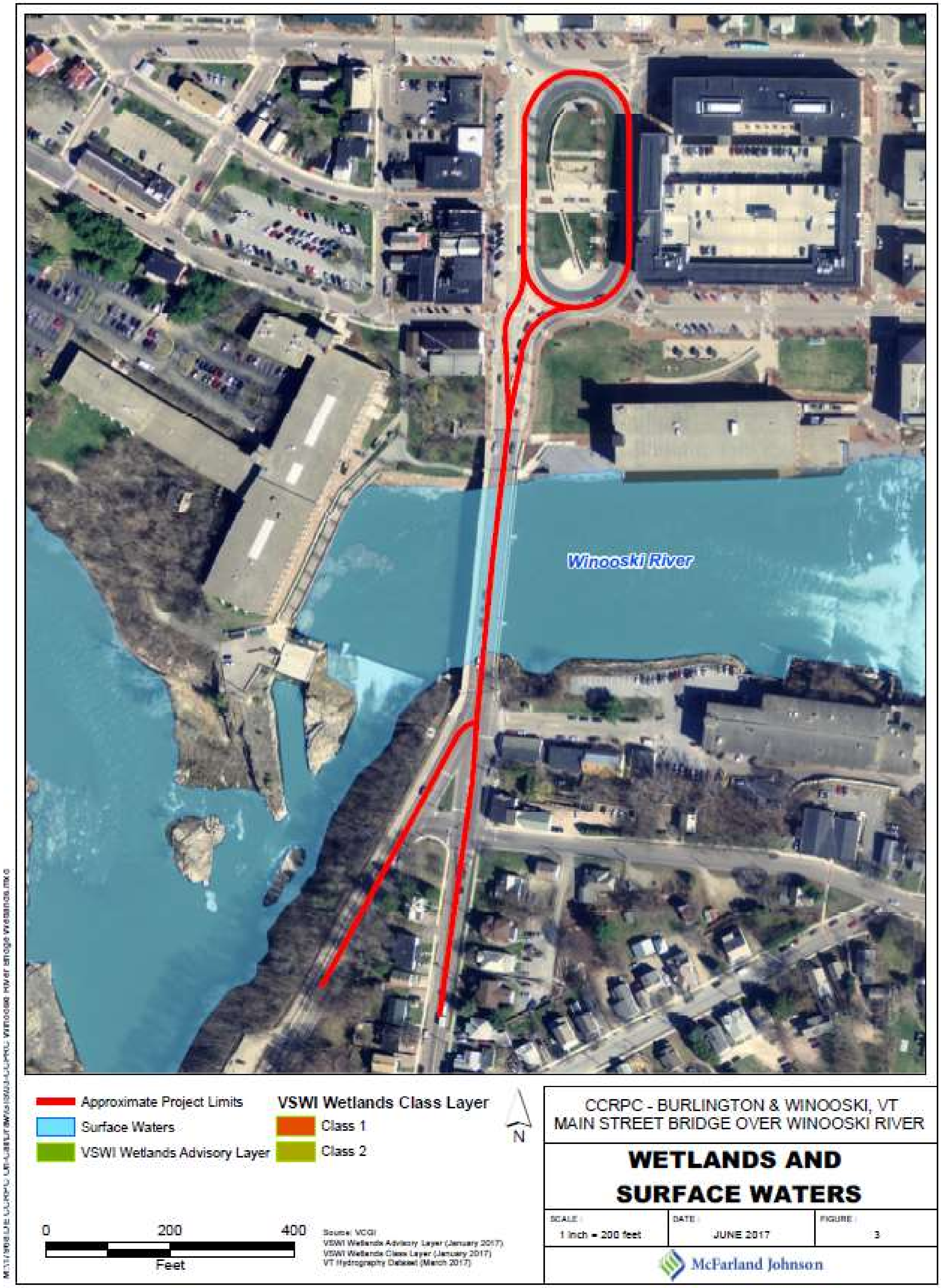


Figure 6 – Floodplains & Floodways

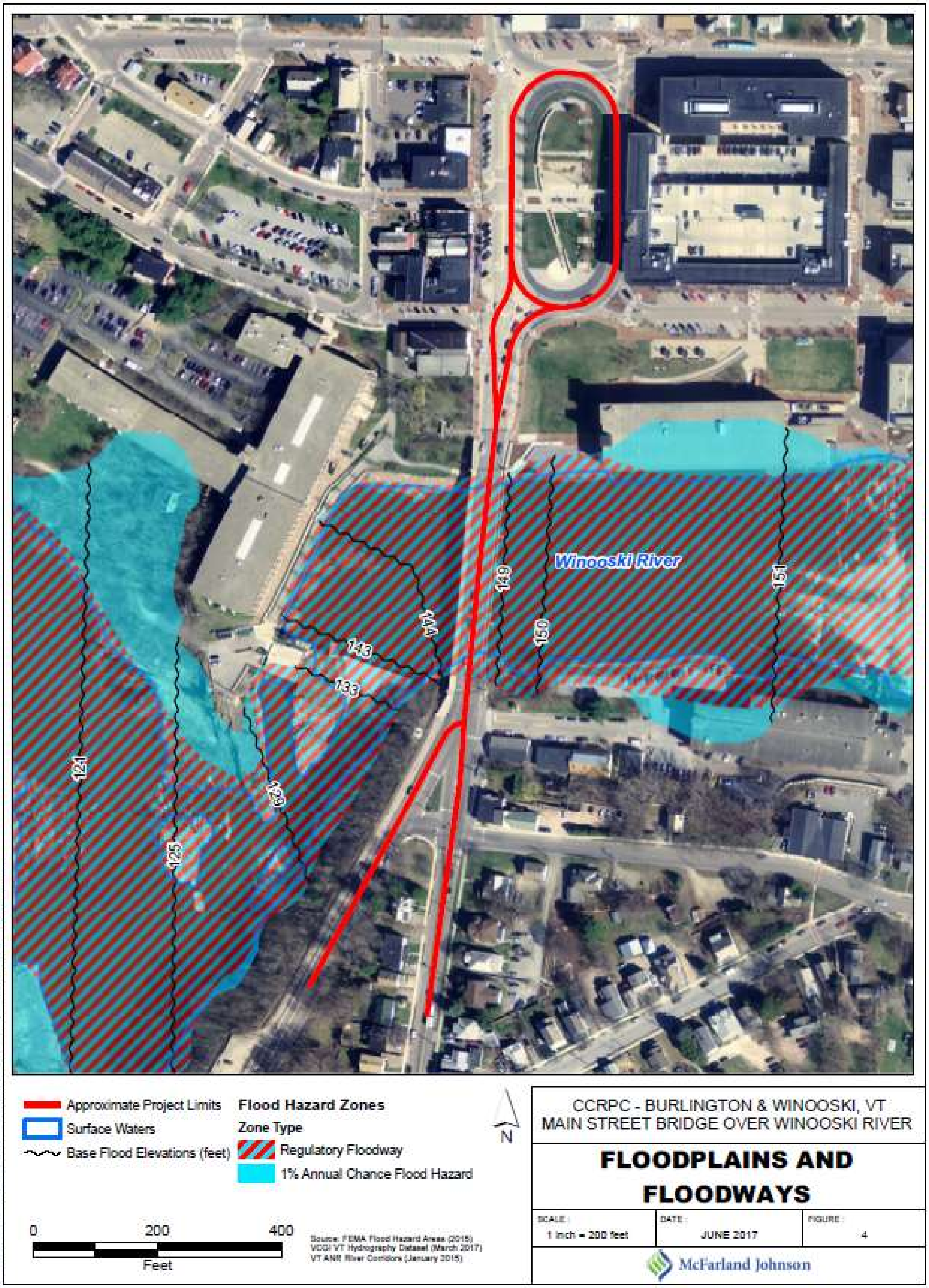


Figure 7 – Hazardous Material Sites

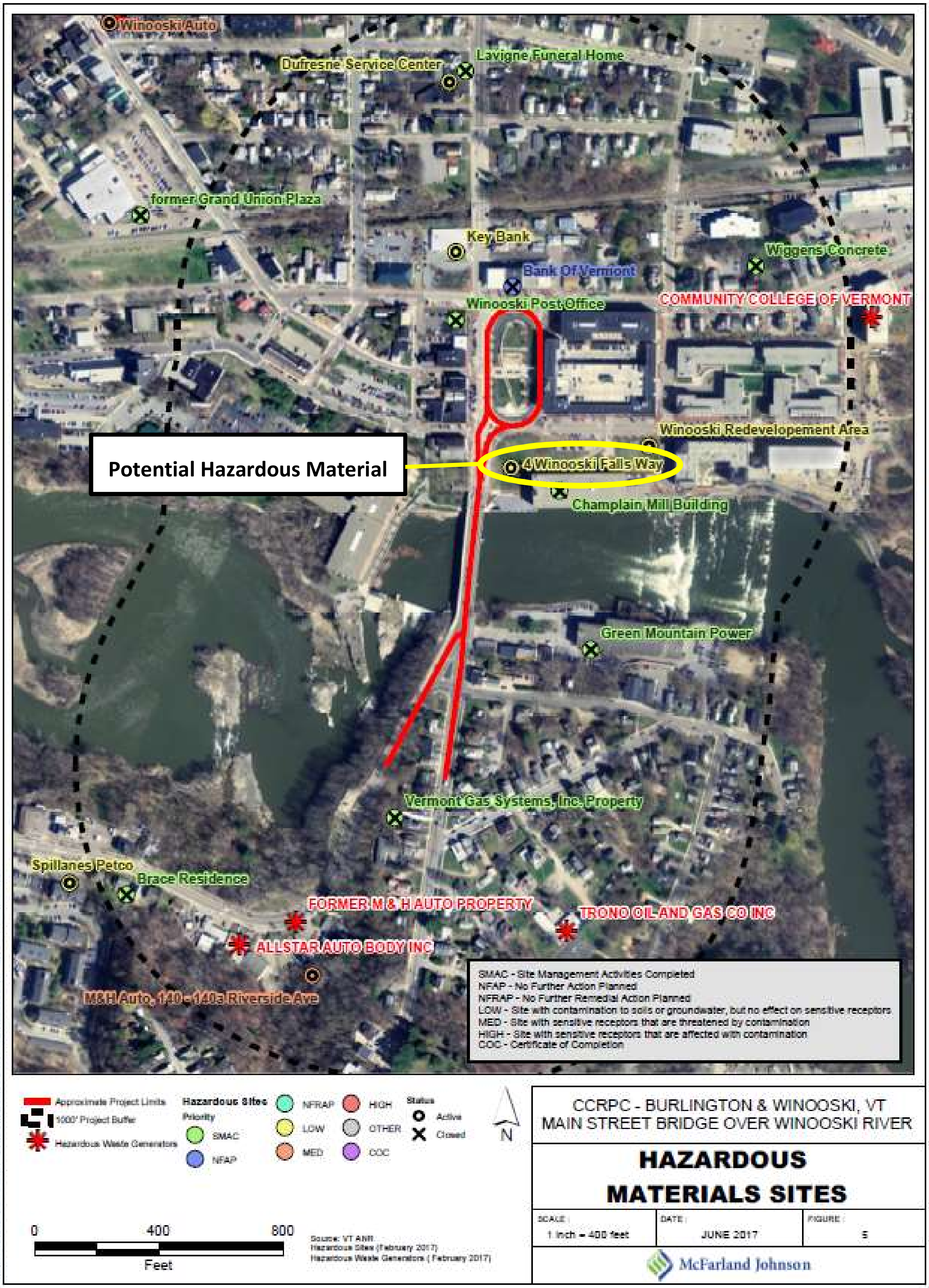


Figure 8 – Habitat Blocks & Wildlife Corridors

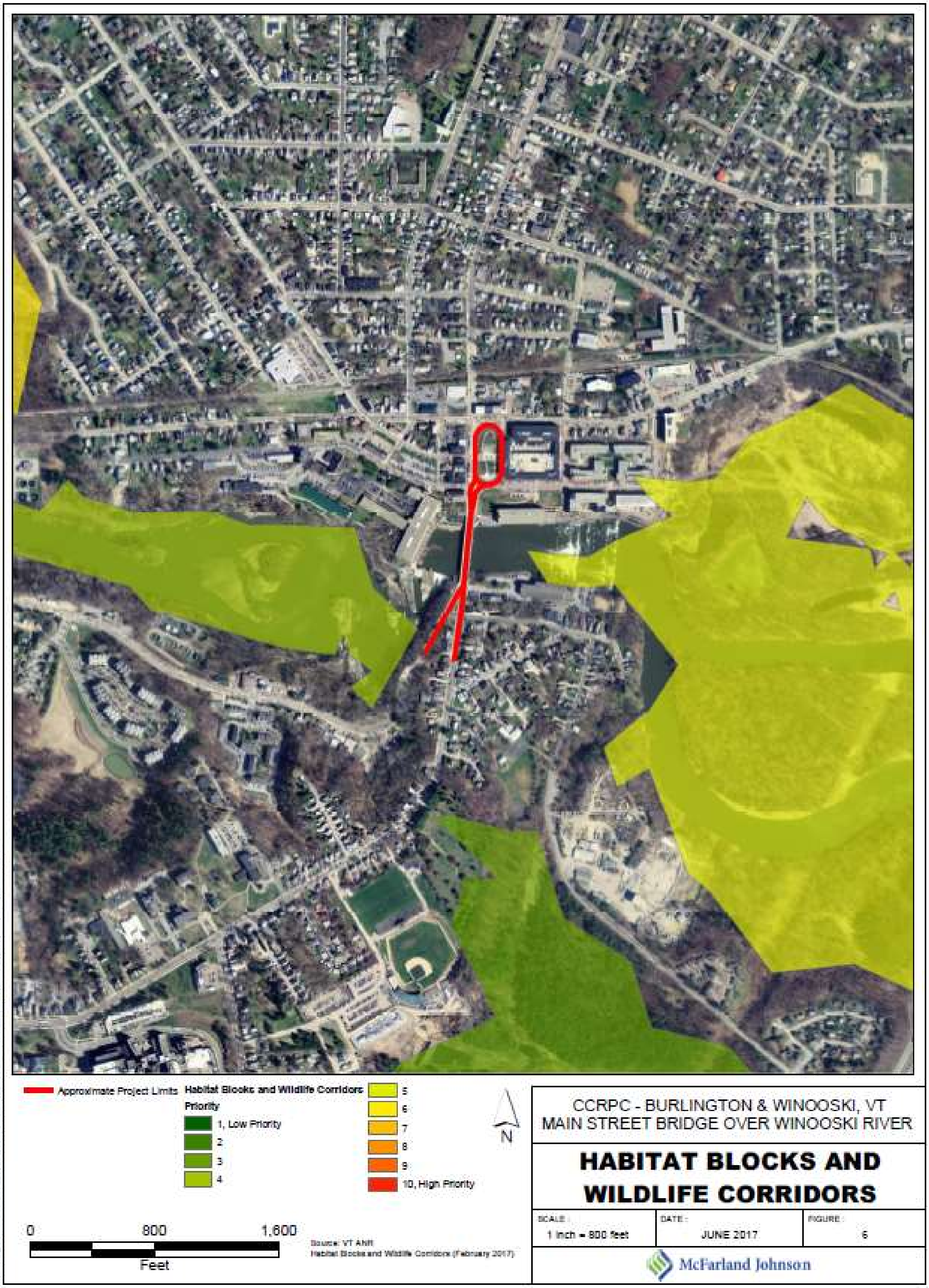


Figure 9 – Rare, Threatened & Endangered Species

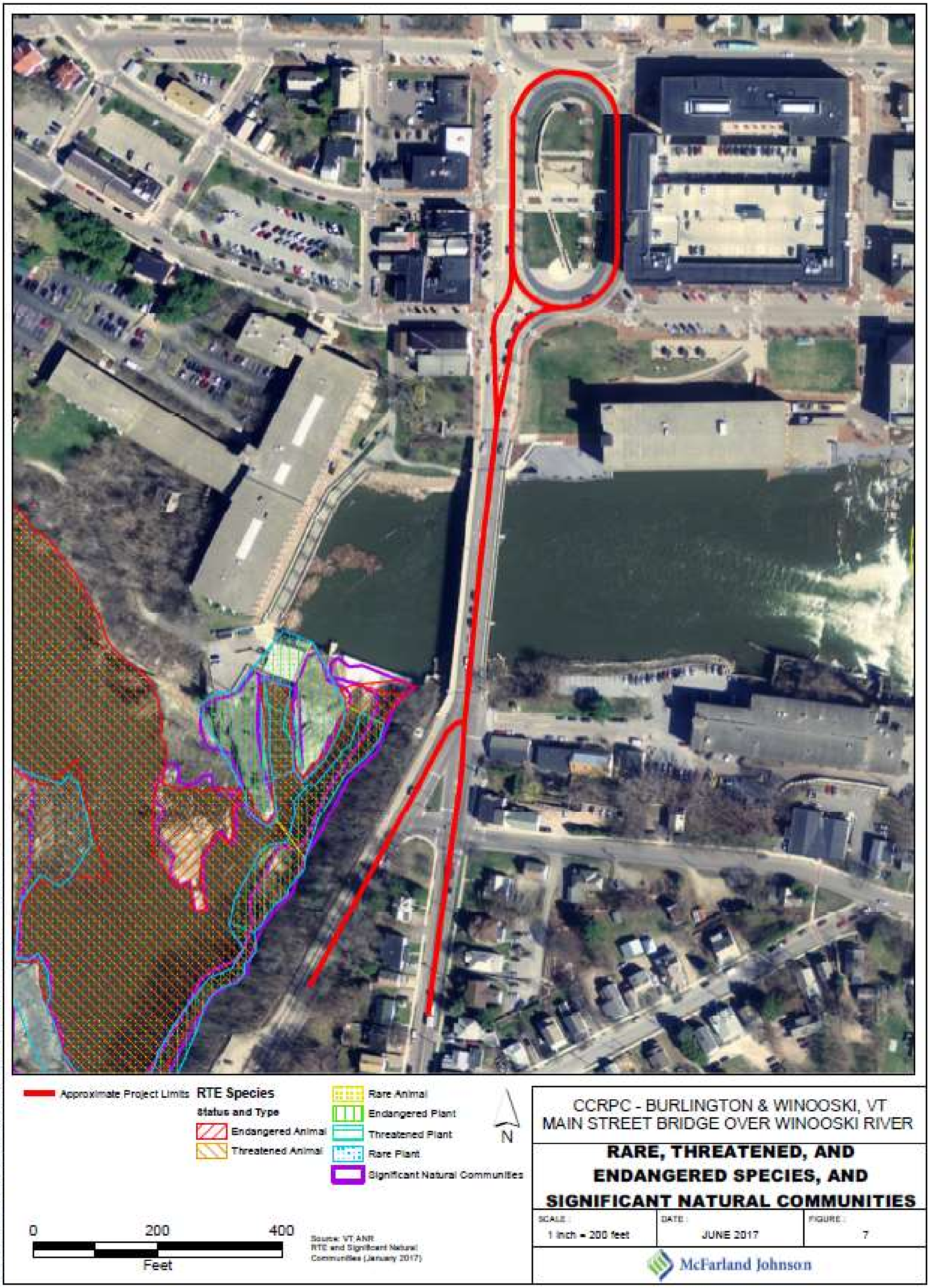
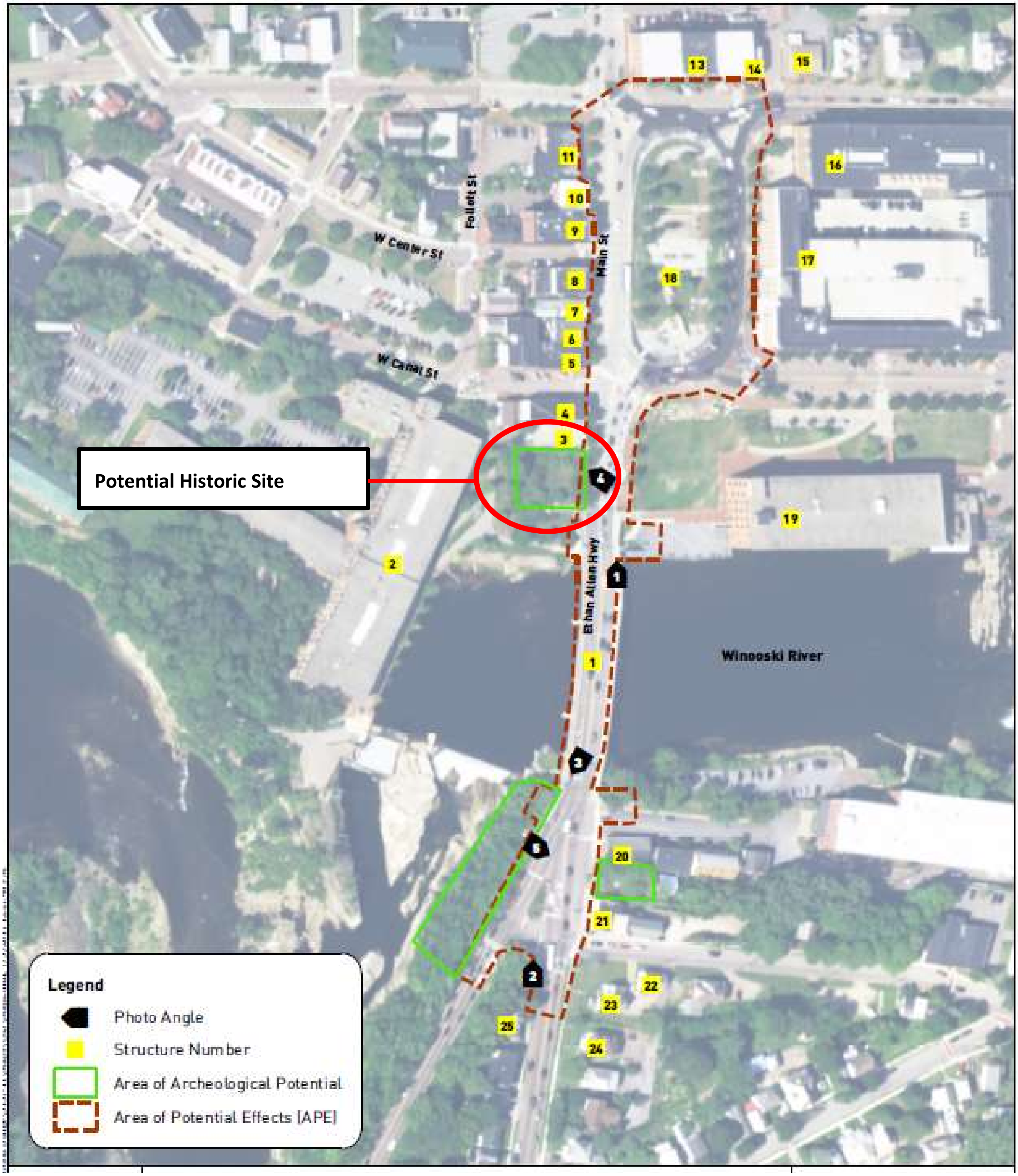


Figure 10 – Conservation & Recreation Lands

Figure 11 – Historic & Archaeological Identification



VI. MAINTENANCE OF TRAFFIC

Due to the urban environment, restrictive site, and transportation capacity demands surrounding the project area, the maintenance of traffic during construction, both vehicular and pedestrian/bike, will be a complex task. Several maintenance of traffic (traffic control) options were identified early in the Scoping Report development process. It was quickly determined that maintaining four lanes of traffic during construction would not be feasible due to the resources adjacent to the bridge. Therefore, four options were investigated including a full bridge closure, maintaining one lane of alternating one-way traffic, maintaining one lane of traffic in each direction, and maintaining one lane of traffic in one direction with two lanes of traffic in the other direction. Since all these options limit the capacity of the roadway over the bridge due to a reduction in travel lanes, it is anticipated that drivers will seek alternate routes during construction. The CCRPC developed a regional traffic model to estimate which alternate routes traffic would use to bypass the construction site. The models showed a majority of traffic using I-89 or Lime Kiln Road to cross the Winooski River and avoid the construction site, both of which are already near capacity during peak travel times. Maps showing the impacts of the additional traffic on the alternate routes are included in Appendix G.

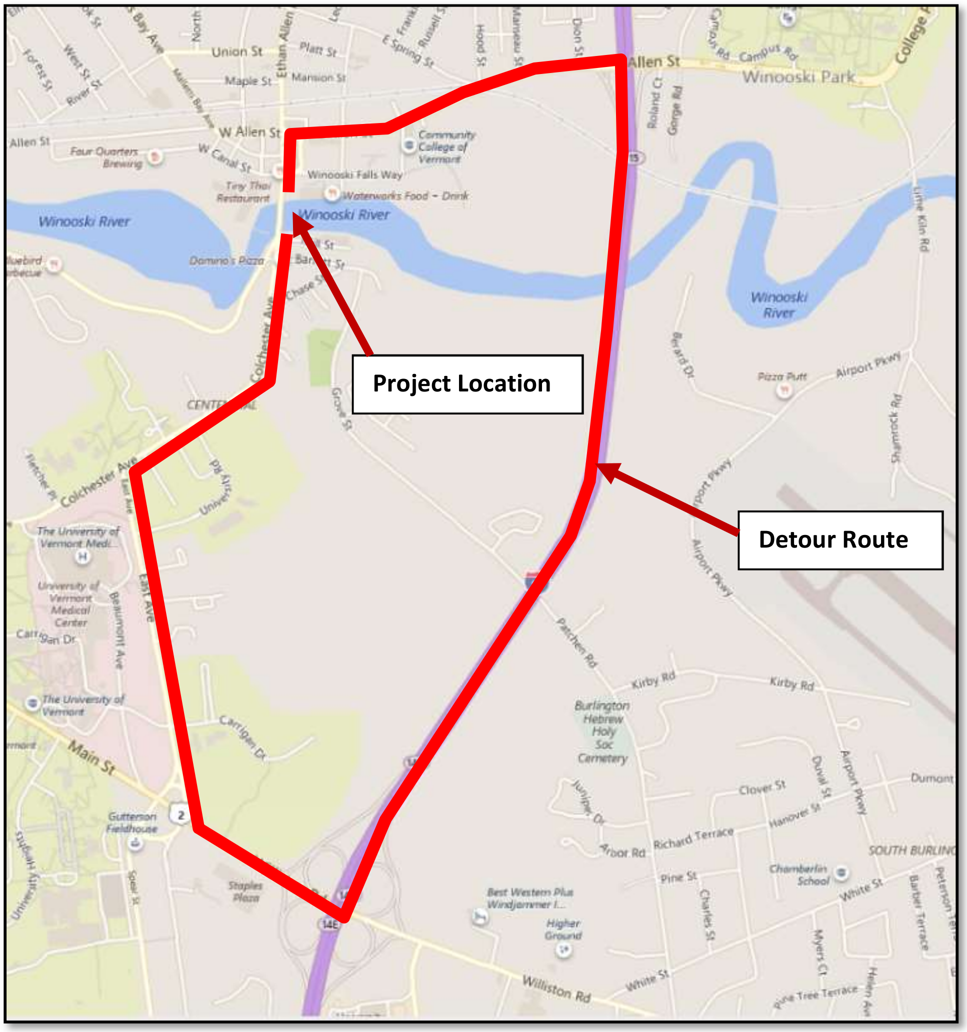
Since the level of traffic diversion between a full bridge closure and maintaining one lane of alternating one-way traffic were similar, the option of maintaining one lane of alternating one-way traffic was discarded. The construction duration of this option would be significantly longer than the full bridge closure option while still having major impacts to regional traffic. Also, the operations of this option would be further complicated due to the proximity of the Riverside Avenue traffic signal in Burlington and the Circulator in Winooski. Therefore, due to providing no project benefits and comparable performance to closing the bridge, alternating one-way traffic was eliminated from consideration.

The remaining traffic control options that have been considered and assessed are summarized below:

OPTION 1: FULL BRIDGE CLOSURE WITH OFF-SITE DETOUR

A full bridge closure would detour vehicular traffic onto I-89 using local streets and is shown in Figure 12 below. The end-to-end detour length of a full bridge closure is approximately 4.5 miles. Pedestrian and bicycle traffic would be maintained on a separate bicycle/pedestrian bridge or through a shuttle service. A summary of this traffic control option assessment, advantages and disadvantages is provided below:

Figure 12 – Full Bridge Closure Traffic Detour



Full Bridge Closure Assessment Summary:

- In addition to utilizing the detour, traffic would also divert to other non-signed detour routes over the Winooski River at Lime Kiln Road and Plattsburg Road (Shown in Appendix G). These roads are already at or near capacity during peak travel times, so the additional traffic would cause additional congestion.
- Some local roadways would see additional volume as the diverted traffic travels to the other Winooski River bridge crossings.
- Traffic volumes in the immediate vicinity of the Main Street bridge would be reduced, leading to less drive-by traffic near local businesses.

A full bridge closure would allow for the use of Accelerated Bridge Construction (ABC), a method of construction which significantly reduces the construction duration, and thus minimizes impacts to traffic. VTrans created the

Accelerated Bridge Program (ABP) in 2012 in an effort to rapidly replace the 13 bridges destroyed by Tropical Storm Irene. Since then, the ABP has been an innovative program whose goal is to reduce impacts to the traveling public by using proven ABC technologies. Typical ABC involves constructing portions of the bridge, commonly referred to as prefabricated bridge elements (PBEs), in advance of the closure off site nearby. The PBEs are then brought to the bridge site during the closure and quickly installed, allowing the bridge to reopen much faster compared to conventional construction methods. The use of ABC has been done throughout the country for over 20 years and has been successfully performed in Vermont on over 80 bridge replacement projects.

The ABC technology being proposed in the alternatives for replacing the Main Street Bridge utilize Lateral Slide Construction methods (also known as Slide-In Bridge Construction). This method of construction requires that the bridge (concrete deck and steel girders) be built directly adjacent to the existing bridge on temporary supports in advance of the bridge closure. The bridge is closed to traffic and the concrete deck and steel girders of the old, existing bridge are removed. The beam seats are reconstructed, and the new bridge is then slid from the temporary supports onto the existing abutment/piers. The approach roadway work is then completed, and the new bridge is then opened to traffic.

One factor in determining if the use of ABC is appropriate for a specific bridge is by placing a monetary value on the expected impacts and delays that traffic will see, typically called the roadway user cost. A full roadway user cost estimate has not been performed for this specific project with a potential ABC bridge replacement option but based on previous projects that have been constructed in Vermont with ABC and the level of traffic on this structure, it can be safely assumed that the roadway user costs will be significantly lower with an ABC replacement compared to conventional construction.

<u>Full Bridge Closure Advantages:</u>

- A full bridge closure would minimize the duration of construction as traffic will not be maintained on the bridge and the Contractor would have full access to the bridge during construction.
- A full bridge closure allows the bridge to be replaced with ABC technology, which will reduce the duration of impacts to traffic from a few years down to a few months when compared to conventional construction.
- The roadway user costs will likely be lowest with a full bridge closure and accelerated bridge construction based on the results of similarly sized projects, as compared to conventional construction.
- ABC construction using the lateral slide technique is easier from a constructability perspective compared to phased construction adjacent to moving traffic.
- ABC construction is the safest method of construction for both roadway users and construction personnel.

<u>Full Bridge Closure Disadvantages:</u>

- Many roads, both primary and secondary arterials, in the surrounding region will see increased traffic with a full bridge closure.
- The traffic impacts with a full bridge closure extend beyond the cities of Burlington and Winooski and into the surrounding communities.

- Less drive-by traffic for local businesses.
- Emergency vehicle response times could be increased due to the detour.
- The long detour makes accommodations through a shuttle service for pedestrians and bicyclists necessary, adding significant pedestrian travel time.

OPTION 2: PHASED CONSTRUCTION WITH TWO LANES OF TRAFFIC MAINTAINED (1 LANE IN EACH DIRECTION)

Phased construction would maintain one lane of traffic in each direction throughout the duration of the project. Depending on the phase and alternative chosen, multiple traffic shifts would be required between the existing and new bridge during construction. Since the capacity of the bridge would be reduced by approximately fifty percent, additional congestion at the Riverside Avenue traffic signal in Burlington and in the Circulator in Winooski would be expected. For this reason, some diversion of traffic to other Winooski River bridge crossings would occur. One sidewalk would be provided to maintain the pedestrian crossing during construction and bicycle traffic would continue to need to "take the lane" while crossing the bridge. A summary of this traffic control option assessment, advantages and disadvantages is provided below:

Two Lanes Maintained Assessment Summary:

- Traffic would divert to the other Winooski River bridge crossings at I-89, Lime Kiln Road, and Plattsburg Road. These roads are already at or near capacity during peak travel times, so the additional traffic could cause additional congestion.

Some local roadways would see additional volume as diverted traffic travels to the other Winooski River bridge crossings. Traffic volumes in the immediate vicinity of the Main Street bridge would be reduced, leading to less drive-by traffic near local businesses.

Two Lanes Maintained Advantages: Traffic is maintained on the structure during construction

- Traffic congestion on diversion routes is substantially less compared to a full bridge closure.
- Maintaining one lane of traffic in each direction allows for a larger area for construction activities to occur on the bridge, thereby shortening the construction duration compared to maintaining three lanes of traffic during construction.
- Emergency vehicle access is maintained during construction.

Two Lanes Maintained Disadvantages:

- One lane of traffic in each direction still results in congestion to numerous roadways in the area, and several roadways, particularly I-89, being over capacity.
- With some traffic diversion, there would be less drive-by traffic for local businesses.
- Phased construction may require multiple years of construction activity on the bridge depending on the Alternative developed and chosen.
- Emergency vehicle response times could be increased due to congested conditions.

OPTION 3: PHASED CONSTRUCTION WITH THREE LANES OF TRAFFIC MAINTAINED (1 SOUTH BOUND LANE AND 2 NORTHBOUND LANES)

Phased construction would maintain one southbound lane of traffic and two northbound lanes of traffic throughout the duration of the project. This orientation was selected since providing two lanes entering the Circulator would provide better traffic operations than only providing a single lane entering the Circulator. Traffic would be maintained, and the bridge would be built using phased construction. Depending on the phase and alternative chosen, multiple traffic shifts would be required between the existing and new bridge during construction. Since the capacity of the bridge would be reduced by approximately twenty five percent, some additional congestion at the Riverside Avenue traffic signal in Burlington and in the Circulator in Winooski would be expected. For this reason, some diversion of traffic to other Winooski River bridge crossings would occur, although not nearly as much as the other traffic control scenarios. One sidewalk would be provided to maintain the pedestrian crossing during construction and bicycle traffic would continue to need to "take the lane" while crossing the bridge. A summary of this traffic control option assessment, advantages and disadvantages is provided below

Three Lanes Maintained Assessment Summary:

- Traffic would divert to the other Winooski River bridge crossings at I-89, Lime Kiln Road, and Plattsburg Road. These roads are already at or near capacity during peak travel times, so the additional traffic would cause additional congestion.
- Some local roadways would see additional volume as diverted traffic travels to the other Winooski River bridge crossings.
- Traffic volumes in the immediate vicinity of the Main Street bridge would be reduced, leading to less drive-by traffic near local businesses.

Three Lanes Maintained Advantages:

- Traffic can be maintained through the existing corridor.
- Impacts to traffic would be slightly reduced compared to Option 2.
- Emergency vehicle access is maintained during construction.

Three Lanes Maintained Disadvantages:

- Construction would require multiple construction phases and take significantly longer than Options 1 & 2 due to the limited work area available to the Contractor.
- The increase in the number of phases increases the amount of construction joints in the bridge deck, which may create a long-term maintenance issue.
- Multiple traffic lane shifts from the old bridge onto the new bridge would be required.

VII. ALTERNATIVES DISCUSSION

Although the bridge is in overall satisfactory condition, it is approaching the end of its design life. The structure is classified as functionally deficient due to sub-standard travel lane widths, no shoulders, and no designated bike lanes, all of which pose safety concerns for all modes of travel. In 2017, RSG completed a traffic assessment (see Appendix G) to evaluate the feasibility of permanently reducing the bridge to three travel lanes to better accommodate pedestrian and bicycle traffic within the existing bridge curb-to-curb width. The traffic assessment concluded that three permanent lanes would result in unacceptable levels of congestion within the study area. Therefore, only alternatives with four travel lanes across the bridge were evaluated. The following alternatives were identified and evaluated based on how well they address the purpose and needs of the project.

NO BUILD

The No Build Alternative leaves the bridge in its current condition and does not address any of the conditional or functional deficiencies of the bridge. The No Build Alternative anticipates that the existing bridge will not require any major rehabilitation work in the next 15 years, which is not a feasible option as the existing superstructure will require both steel and concrete repairs in the near future. In the interest of safety to the traveling public, the No Build Alternative is not recommended. No cost estimate has been developed for this alternative as there are no immediate costs. Early in the process it was determined that the No Build Alternative did not meet the requirements of the Purpose and Need statement, and therefore the ***No Build Alternative was eliminated from consideration***.

ALTERNATIVE 1 - BRIDGE SUPERSTRUCTURE REHABILITATION WITH OFFLINE PEDESTRIAN/BIKE BRIDGE

The Bridge Superstructure Rehabilitation Alternative will address the immediate conditional deficiencies as found in the latest inspection report. Rehabilitation work will include the following:

- Cleaning and patching of loose and deteriorated (spalled) concrete on the bridge deck and sidewalks. This will also include spalled areas on the underside of the deck.
- Spot cleaning and painting of the existing steel girders.

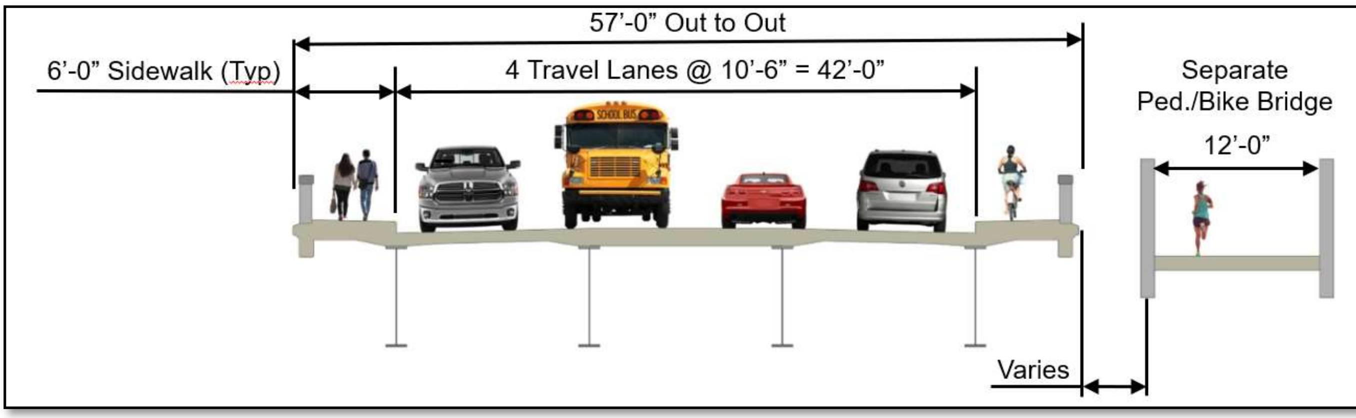
With the repairs listed above and given that the deck and superstructure have a satisfactory condition rating, it is anticipated that the service life of the bridge will be extended 50 years. These repairs will improve the overall structural condition of the bridge, but do not address the current functional deficiencies, as the bridge will still have sub-standard travel lane, shoulder and sidewalk widths.

In addition to the superstructure rehabilitation, this alternative will include the construction of an off-alignment pedestrian/bike bridge, based on the recommendations provided in the Bike & Pedestrian study published in 2017. Since the bridge rehabilitation does not address the safety concerns for pedestrians, a separate pedestrian/bike bridge will provide a safe crossing for bicyclists and pedestrians as defined in the project's Purpose and Need statement. The recommendations for the proposed location of this separate structure based on the 2017 study were reviewed, and through discussions with the Advisory Committee, the following recommendations were made:

- The ideal location for the separate pedestrian/bicycle bridge is immediately adjacent to and at the same elevation as the existing bridge. This location is defined as Alignment A in the 2017 Bike & Pedestrian Study.
- Locating the separate bridge immediately downstream (west) of the existing bridge is the preferred location due to the large volume of pedestrians and bicyclists using Riverside Avenue.

A typical bridge section of Alternative 1 is provided in Figure 13 below:

Figure 13 - Alternative 1 Typical Bridge Section (Looking South toward Burlington)



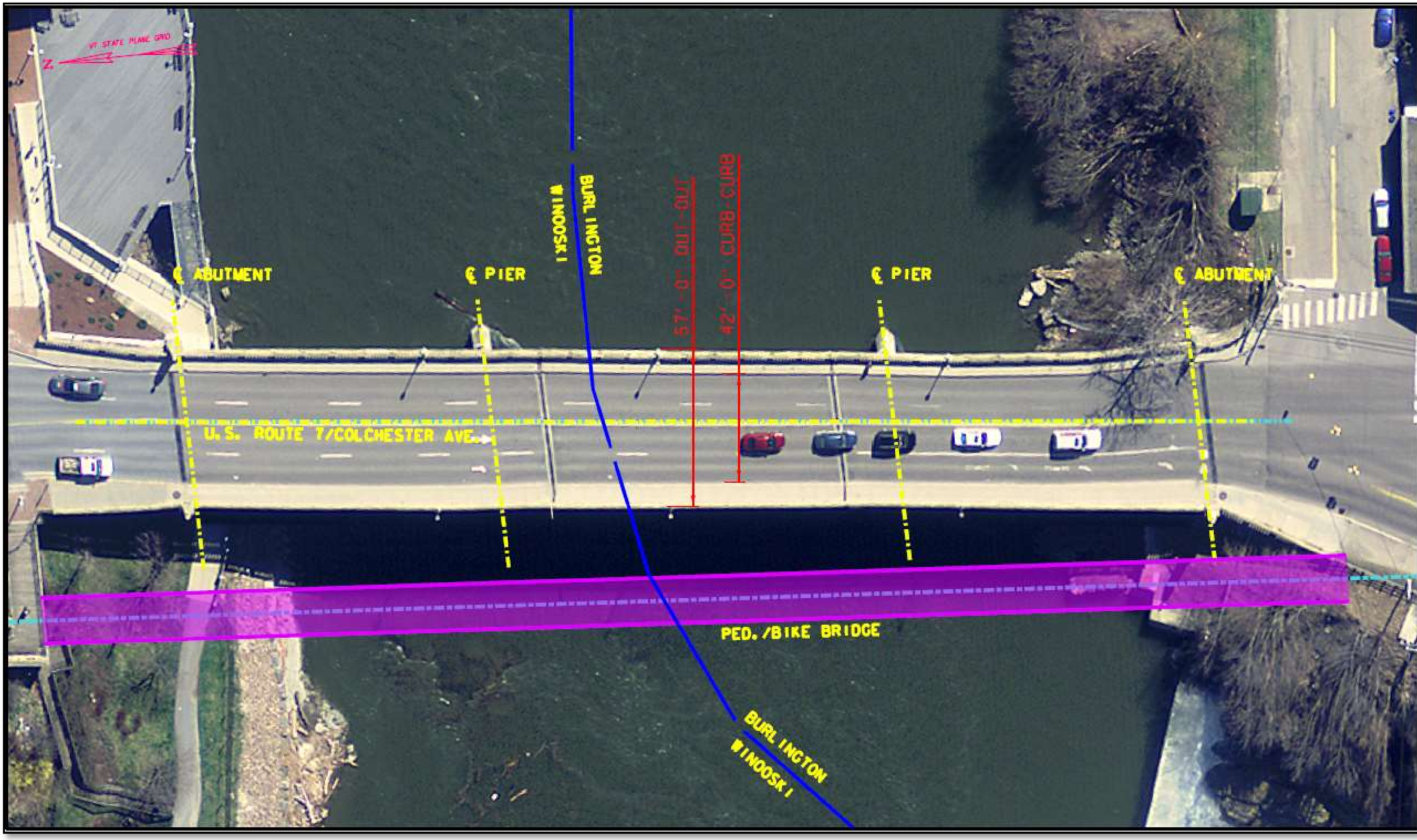
One configuration that was briefly explored was to remove one of the existing sidewalks to provide additional shoulder width across the bridge. However, this option is not feasible due to the existing girder locations and overhang brackets. The existing structure cannot safely support placed outside of the exterior girders on the overhang.

This alternative will require that pedestrians and bicyclists on the upstream (east) side of the bridge who wish to use the newly constructed bike and pedestrian bridge use nearby crosswalks. These crosswalks are not anticipated to be located at the immediate ends of both bridges and is therefore an additional safety hazard for bicyclists and pedestrians who wish to use the separate pedestrian/bike structure.

The existing piers and abutments are in overall good condition and are not in need of any immediate extensive concrete repairs. Since all substructure units are cast directly onto bedrock they have little susceptibility to scour, and therefore no scour control measures will be provided for the piers. For the purposes of this study, it is reasonable to assume the existing substructure units can safely carry traffic loads for another 50 years without requiring significant maintenance and rehabilitation.

See Figure 14 below for a plan view illustrating Alternative 1.

Figure 14 – Alternative 1 Plan View



ALTERNATIVE 2 - BRIDGE SUPERSTRUCTURE REPLACEMENT WITH OFFLINE PED./BIKE BRIDGE

This alternative will entail replacing the superstructure of the existing bridge. This alternative requires the following major construction items:

- Replacing the existing deck with a new concrete bridge deck.
- Replacing the existing steel girders with new steel girders.
- Rehabilitating the existing steel girder seats (beam seats) on the existing piers and abutments to accommodate the proposed steel girders.
- Rehabilitating the existing abutment backwalls and beam seats to accommodate the proposed steel girders.

Due to the unconventional steel overhang brackets that support the existing sidewalks, it is not feasible to increase the bridge width without widening the existing substructure units. For that reason, this alternative reduces the overall width of the bridge, reduces sidewalk width, maintains the current lane and shoulder widths, and maintains the existing horizontal and vertical alignments. Like Alternative 1, this alternative will locate a separate pedestrian/bicycle bridge adjacent to the proposed structure to satisfy the project's purpose and need statement of providing dedicated facilities for bicycle and pedestrian traffic in both directions of the bridge. The location of pedestrian and bicycle bridge will be similar to Alternative 1, which is adjacent to the proposed bridge on the downstream (west) side of the structure.

Since vehicular traffic can be reconfigured given the new girder layout and a pedestrian/bicycle bridge will be provided adjacent to the bridge structure, different combinations of shoulders and sidewalks could be provided. Through discussions with the Advisory Committee, it was determined that for this Alternative, it would be preferred to provide both a sidewalk and a bike lane on the northbound (east) side of the bridge. Pedestrians and bicyclists traveling northbound on the bridge would utilize their respective paths provided on the Main Street Bridge, while pedestrians and bicyclists traveling southbound would utilize the adjacent pedestrian/bicycle bridge Figure 15 below shows the proposed typical bridge section for Alternative 2.

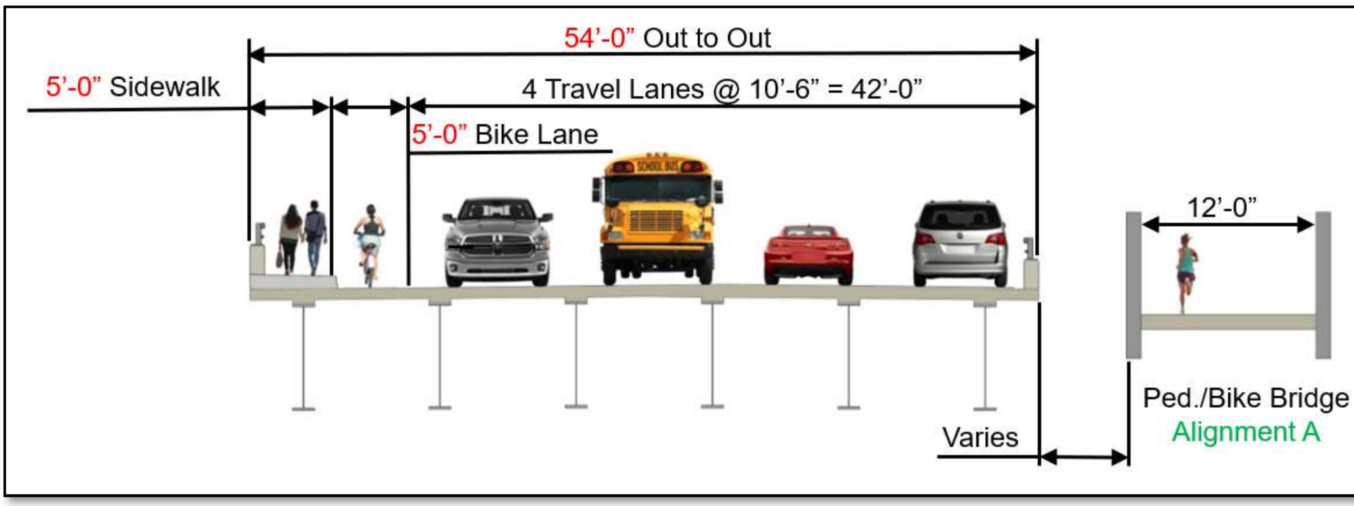
This bridge typical section will require that pedestrians and bicyclists on the upstream (east) side of the bridge who wish to use the newly constructed bike and pedestrian bridge use nearby crosswalks. These crosswalks are not anticipated to be located at the immediate ends of both bridges and is therefore an additional safety hazard for bicyclists and pedestrians who wish to use the separate pedestrian/bike structure.

A summary of the proposed widths provided on the bridge for this alternative compared to the existing structure is provided in Table 3 below:

Table 3 - Alternative 2 Comparison to Existing Bridge

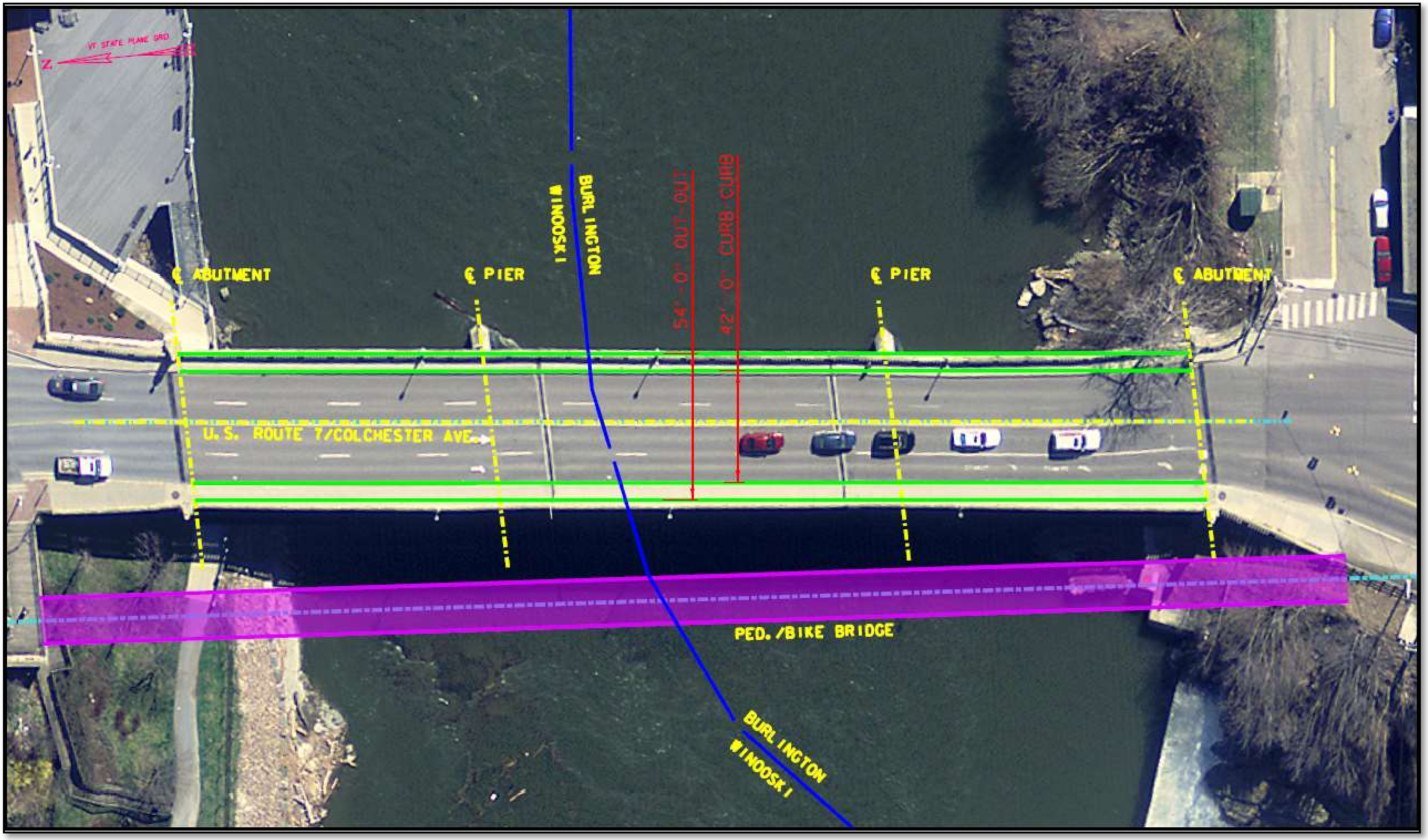
Bridge Widths - Alternative 2 vs Existing Bridge		
Description	**Alternative 2**	**Existing Bridge**
Total Bridge Width	54’-0”	57’-0”
Northbound Sidewalk Width	5’-0”	6’-0”
Travel Lane Width	10’-6”	10’-6”
Northbound Shoulder Width	5’-0” Bike Lane	None Provided

Figure 15 - Alternative 2 Typical Bridge Section (Looking South toward Burlington)



The existing piers and abutments are in overall good condition and are not in need of any immediate extensive concrete repairs. The existing piers and abutments will undergo minor repairs to any cracking or surface deficiencies. Modifications to the bridge seats of each substructure unit will be required to accommodate the new superstructure depth and bearing configuration. Since all substructure units are cast directly onto bedrock, they have little susceptibility to scour, and therefore no scour control measures will be provided. For the purposes of this study, it is reasonable to assume the existing substructure units can safely carry traffic loads for another 50 years without requiring significant maintenance and rehabilitation. See Figure 16 below for a plan view illustrating Alternative 2.

Figure 16 – Alternative 2 Plan View



ALTERNATIVE 3 - BRIDGE SUPERSTRUCTURE REPLACEMENT WITH UPSTREAM ALIGNMENT SHIFT

This alternative will replace the existing superstructure and widen the existing piers and abutments to allow for a wider bridge. The majority of the widening will occur on the upstream (east) side of the bridge and will require the horizontal alignment of the roadway to be shifted upstream approximately 11 feet. The vertical roadway alignment will remain unchanged.

The bridge width will increase to 76’-0” to meet current roadway design guidelines. A summary of the proposed widths provided on the bridge for this alternative compared to the existing structure is provided in Table 4 below:

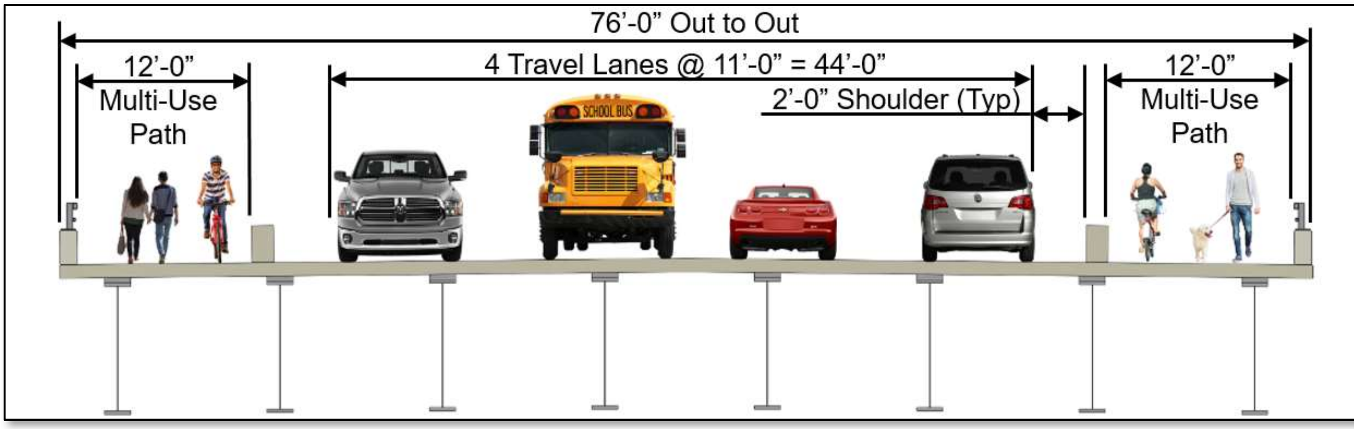
Table 4 – Alternative 3 Comparison to Existing Bridge

Bridge Widths - Alternative 3 vs Existing Bridge		
Description	**Alternative 3**	**Existing Bridge**
Total Bridge Width	76’-0”	57’-0”
Northbound Sidewalk Width	12’-0” (Multi-Use Path)	6’-0” Sidewalk
Travel Lane Width	11’-0”	10’-6”
Shoulder Widths	2’-0”	None Provided
Southbound Sidewalk Width	12’-0” (Multi-Use Path)	6’-0” Sidewalk

With an increased bridge width, different pedestrian/bicycle treatments could be provided such as designated bicycle lanes, raised sidewalks, or protected multi-use paths. Through discussions with the Advisory Committee, it was determined that a protected multi-use path should be provided on each side of the bridge. This path would be at the same elevation as the roadway but would be protected from adjacent vehicular traffic via a concrete barrier system. Each multi-use path would connect to existing sidewalks on each side of the bridge as well as the Riverside Avenue shared use path on the Burlington side.

A typical bridge section of Alternative 3 is provided in Figure 17 below:

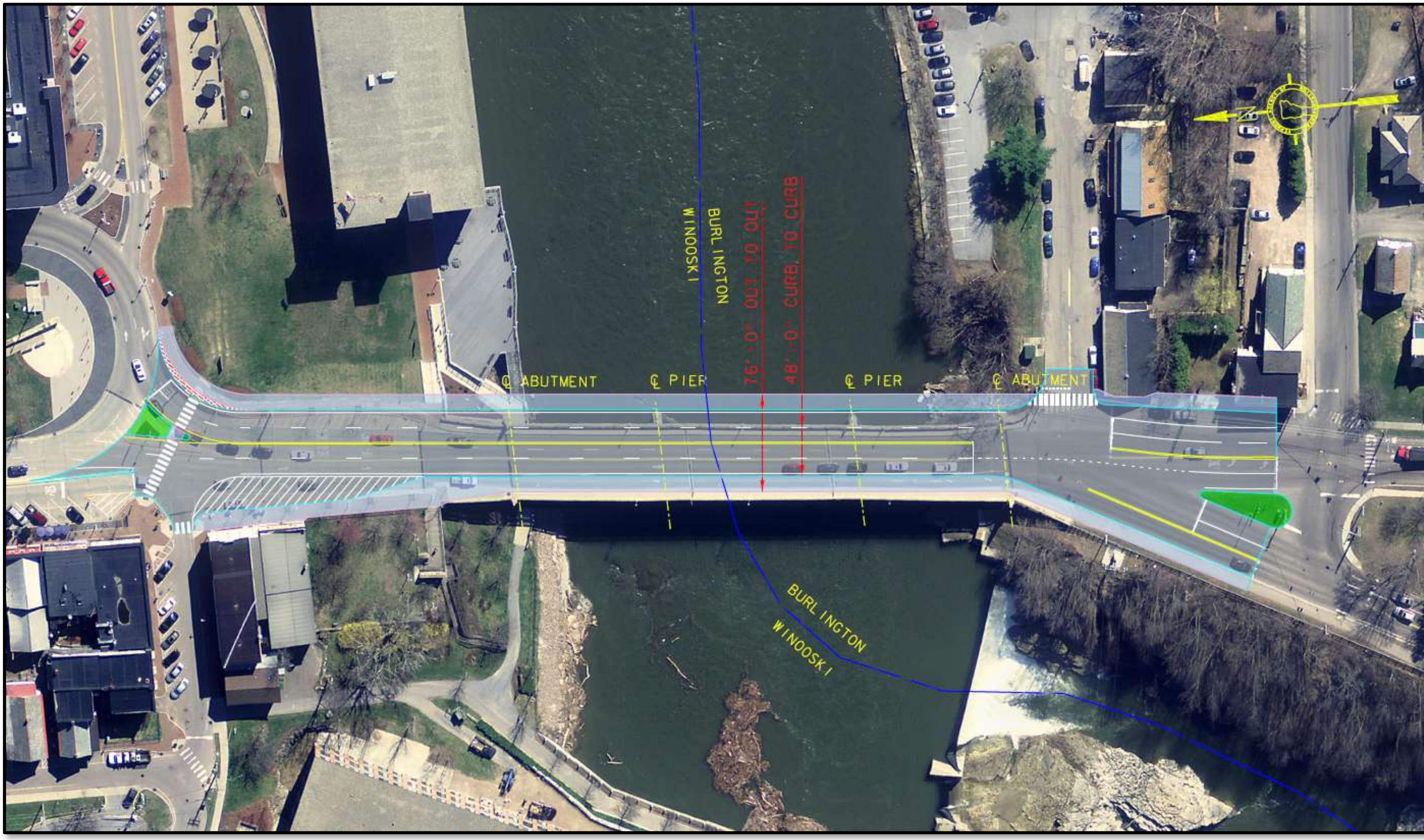
Figure 17 - Alternative 3 Typical Bridge Section (Looking South toward Burlington)



Modifications to the existing piers and abutments will include minor repairs, bridge seat modifications, and widening. Minor repairs to any cracking or surface deficiencies are expected to be necessary prior to casting the widened portion. Bridge seat modifications will be required to accommodate the new superstructure depth and bearing configuration. Pier widening will be accomplished by drilling and grouting dowels into the existing piers and pouring new concrete to act monolithic with existing concrete. Widened sections of substructure units will be supported by either bearing directly onto bedrock or by some form of rock doweling or drilled rock socket. The exact method of construction will be finalized after the subsurface exploration (borings) has been completed.

Due to the bridge width required to accommodate the proposed facilities, this alternative would widen the existing piers and abutments on each side. The alignment shift to the east of approximately 11 feet will require widening the existing piers and abutments primarily on the upstream side. The amount of widening required will not be fully determined until the final detailed design phase of the project. This alignment shift of the bridge requires some modifications to both approach roadways. This shift was reviewed, and it was determined that it will not preclude any alternatives that may be constructed at the future Colchester/Riverside Avenue intersection. An aerial plan view of Alternative 3 is provided in Figure 18 below:

Figure 18 – Alternative 3 Plan View



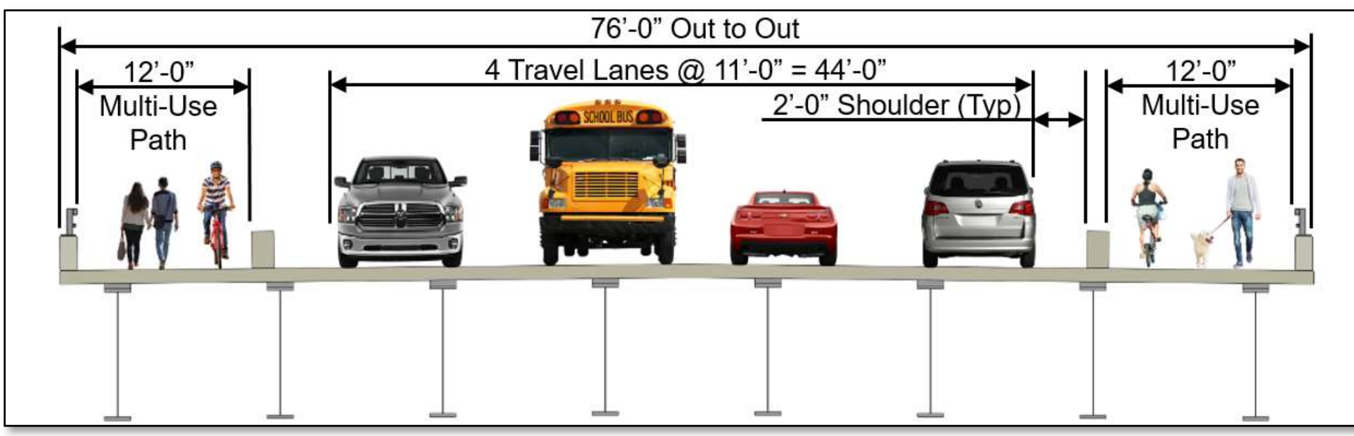
ALTERNATIVE 4 - BRIDGE SUPERSTRUCTURE REPLACEMENT WITH DOWNSTREAM ALIGNMENT SHIFT (WITH ABC CONSTRUCTION TECHNIQUES)

Alternative 4 is similar to Alternative 3, however the existing substructure units are widened downstream rather than upstream. The alignment for Alternative 4 is also shifted downstream (to the west) to accommodate this wider structure. The proposed bridge width would be similar to Alternative 3, and is summarized in Table 5 and shown in Figure 19 below:

Table 5 - Alternative 4 Comparison to Existing Bridge

Bridge Widths - Alternative 4 vs Existing Bridge		
Description	**Alternative 4**	**Existing Bridge**
Total Bridge Width	76'-0"	57'-0"
Northbound Sidewalk Width	12'-0" (Multi-Use Path)	6'-0" Sidewalk
Travel Lane Width	11'-0"	10'-6"
Shoulder Widths	2'-0"	None Provided
Southbound Sidewalk Width	12'-0" (Multi-Use Path)	6'-0" Sidewalk

Figure 19 - Alternative 4 Typical Bridge Section (Looking South toward Burlington)

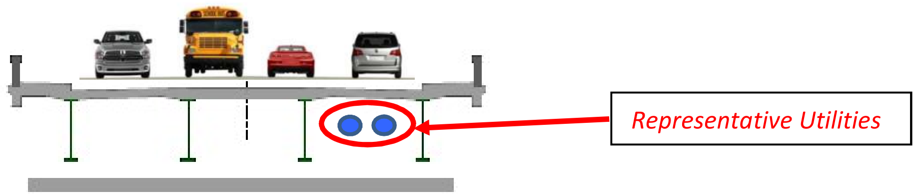


A full bridge closure was evaluated for this alternative, due to the traffic impacts associated with maintaining two lanes or three lanes of traffic for several (2-3) construction seasons. The use of Accelerated Bridge Construction (ABC) techniques was evaluated to determine if it was a feasible option. ABC is a method of construction where elements of the bridge are fabricated in advance of the bridge closure, and then shipped/moved to the site and assembled during a relatively short bridge closure, substantially reducing the impacts to the public using the bridge. The use of ABC techniques is very common in the state of Vermont and is considered the default method of construction statewide for bridge replacement projects.

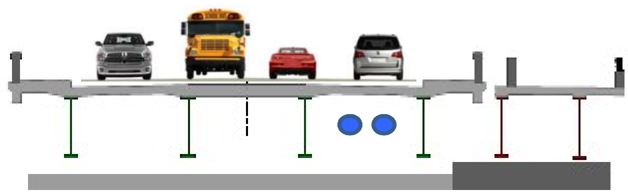
For this structure, the method of ABC construction that was determined to be most ideally suited for this site is the bridge lateral slide method. This method of construction requires that the bridge (concrete deck and steel girders) be built directly adjacent to the existing bridge on temporary supports in advance of the bridge closure. Once the bridge is closed, the concrete deck and steel girders are removed from the existing bridge. The beam seats are reconstructed, and the new bridge is then slid from the temporary supports onto the existing abutment/piers. The approach roadway work is then completed, and the new bridge is then opened to traffic.

The downstream alignment shift with Alternative 4 allows for a portion of the new bridge to be built downstream of the existing bridge on the widened piers and abutments in advance of the full bridge closure. This section can potentially be used as a pedestrian/bike bridge and provide emergency vehicle access during the bridge closure. Another benefit of building a portion of the new bridge in advance is that the utilities can be relocated prior to the bridge closure, which is a substantial savings in construction time, coordination, and impacts to traffic. The rest of the bridge will be constructed using bridge lateral slide ABC methods, which will further reduce the impacted traffic duration. A phasing diagram showing the assumed sequence of construction using ABC methods for Alternative 4 is shown in Figure 20 below:

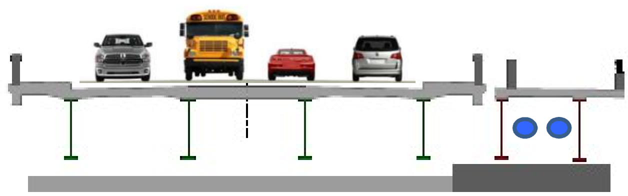
Figure 20 - Alternative 4 ABC Phasing



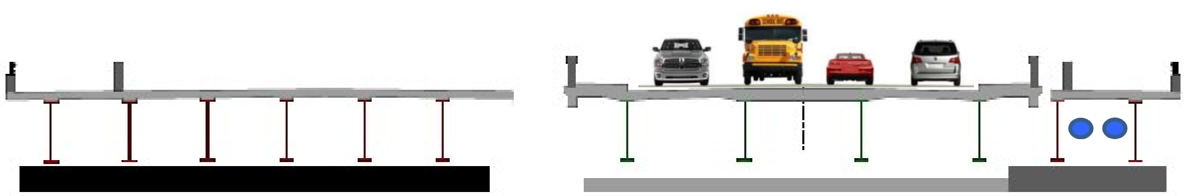
Existing Condition



Phase 1 – Widened Portion of Substructure Units and Superstructure Constructed

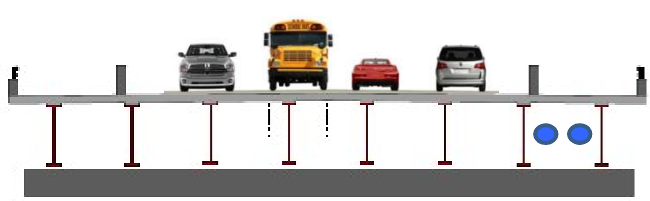


Phase 1a – Utilities Relocated



Phase 2 – New Bridge Superstructure Built Adjacent to Existing Bridge on Temporary Supports

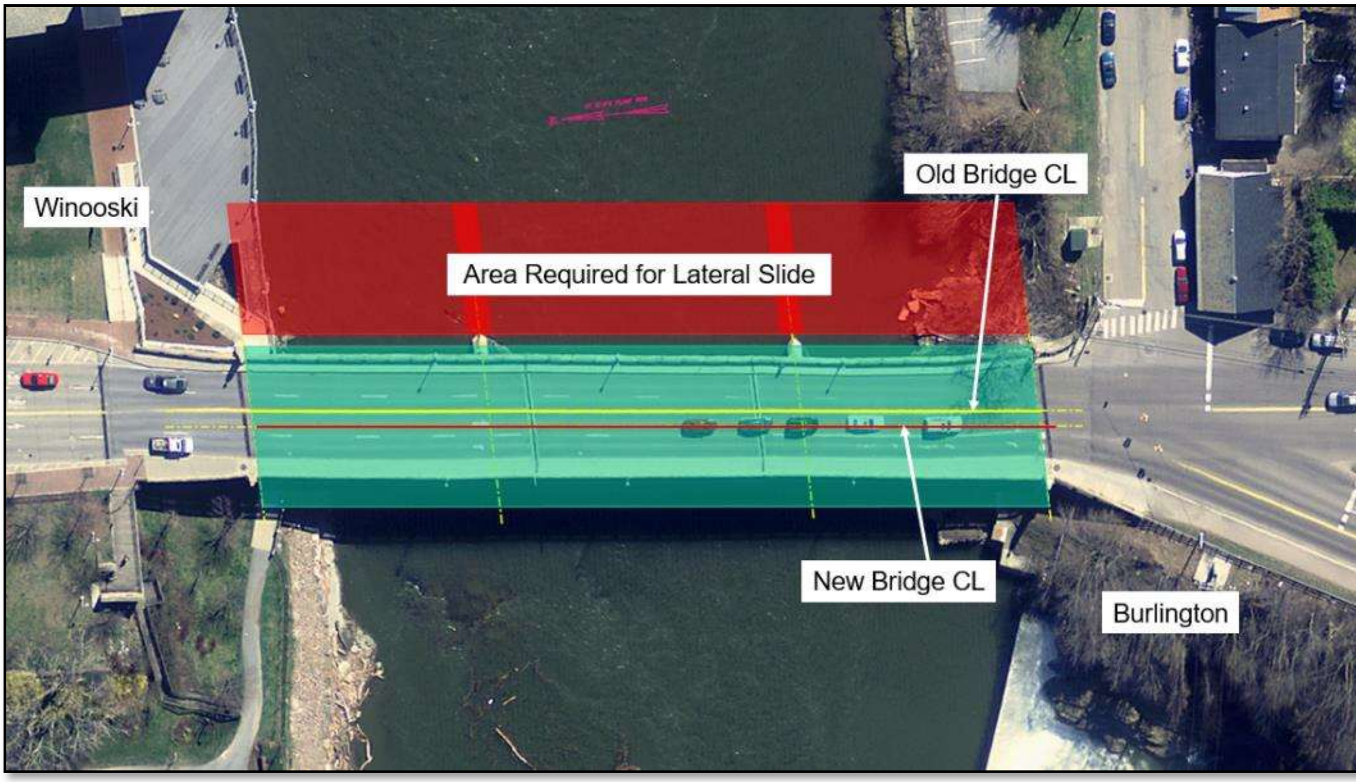
Phase 3 – Bridge Closed to Traffic, Existing Bridge Superstructure Removed, and New Bridge Superstructure Slid to Final Location



Phase 4 - New Bridge Opened to Traffic

The use of ABC techniques with Alternative 4 would require a substantial area for the bridge superstructure to be constructed prior to the bridge closure. Due to the proximity of the dam structure, the only available location to construct the bridge would be upstream of the existing bridge (this is why ABC is not possible with the upstream shift of Alternative 3). The approximate location of the area required to construct the bridge is shown in Figure 21 below:

Figure 21 – Alternative 4 Aerial View with Lateral Slide

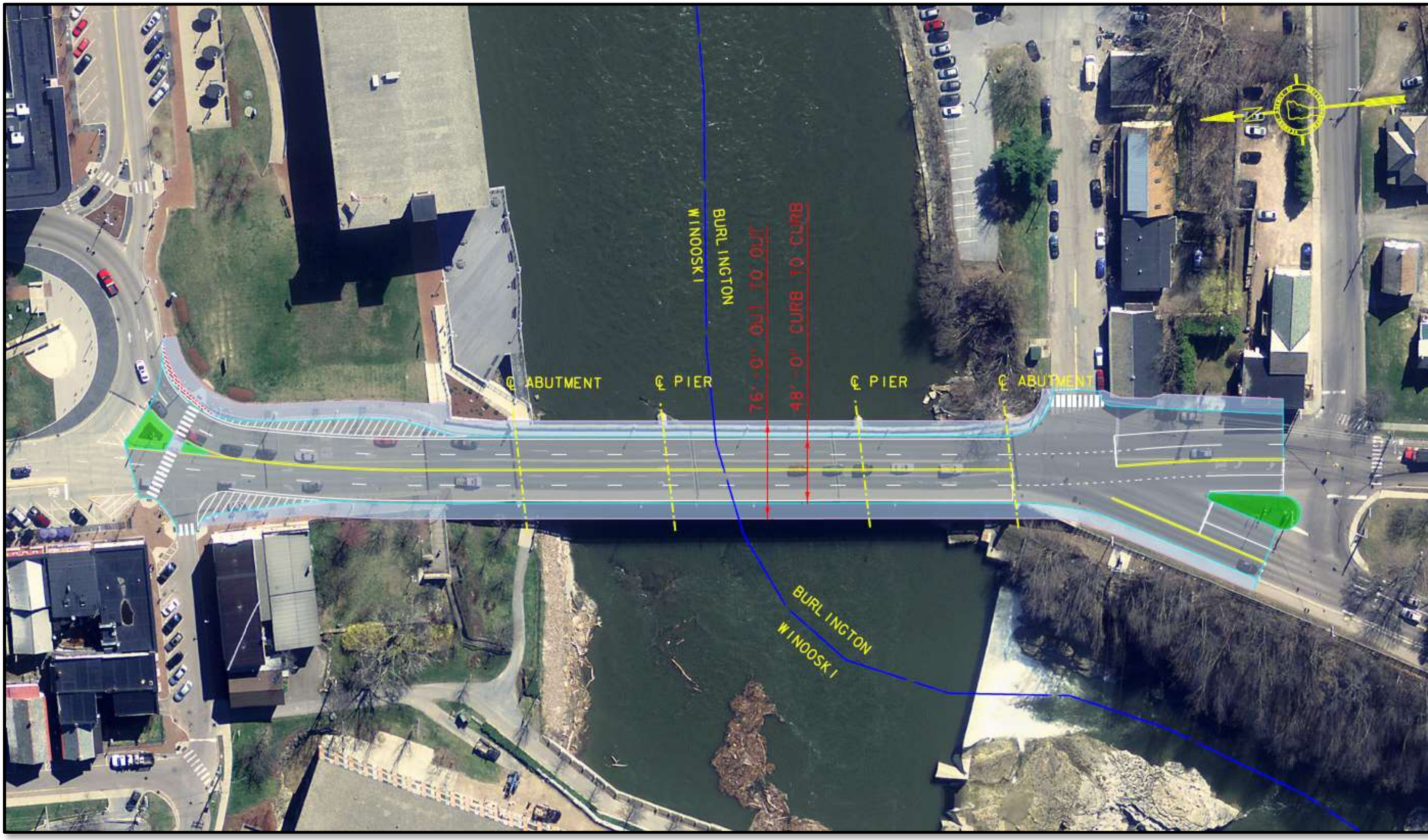


It is anticipated that a portion of the parking lot on Mill Street and the Winooski Riverfront Park at the southeast and northeast corners of the bridge, respectively, would require closure. Both will require reconstruction after the bridge is re-opened to traffic.

The use of ABC techniques would require complete closure of the bridge, which would have large traffic impacts to the surrounding communities. The duration of the bridge closure cannot be determined until final design; however, it is anticipated that a closure duration of 4-6 weeks would be required to remove the old bridge, slide the new bridge into place and reopen the structure to traffic. This is a major reduction in duration of traffic impacts when compared to the estimated construction duration of 2-3 years for conventional construction.

Due to the bridge width required to accommodate the proposed facilities, this alternative would widen the existing piers and abutments on each side. Alternative 4 would widen the existing piers primarily to the downstream side. By widening to the downstream side, the alignment of the existing bridge would shift to the west by approximately 7'. This alignment shift of the bridge requires some modifications to both approach roadways. This shift was reviewed, and it was determined that it will not preclude any alternatives that may be constructed at the future Colchester/Riverside Avenue intersection. An aerial plan view of Alternative 4 is provided in Figure 22 below:

Figure 22 – Alternative 4 Plan View



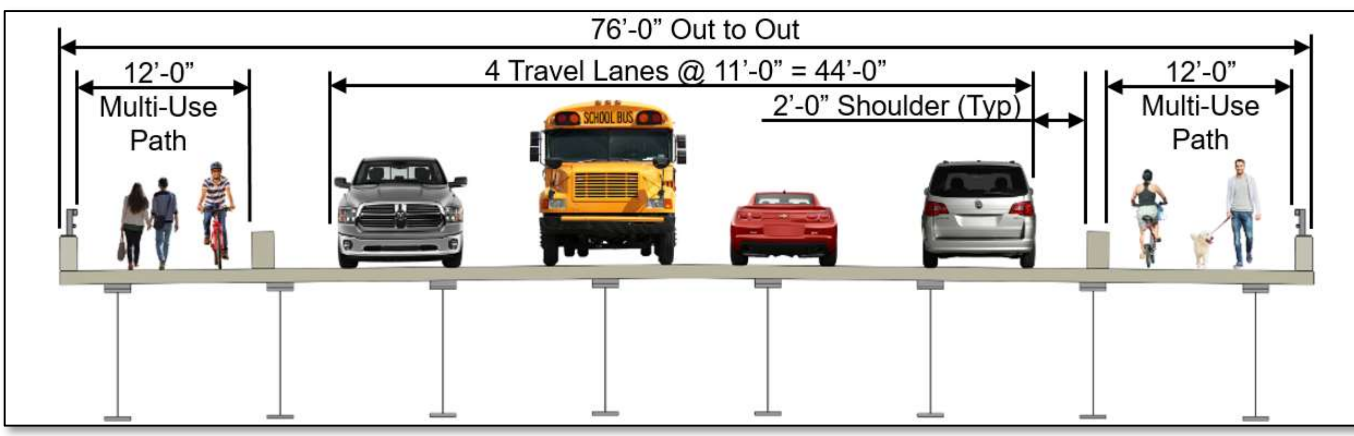
ALTERNATIVE 5 - COMPLETE BRIDGE REPLACEMENT WITH 2 SPAN STRUCTURE (WITH ABC CONSTRUCTION TECHNIQUES)

Alternative 5 is a complete bridge replacement which removes the superstructure, piers, and abutments of the existing three-span structure and replaces it with a completely new two span structure. The proposed superstructure of this alternative is similar to Alternatives 3 & 4, and is summarized in Table 6 & Figure 23 below:

Table 6 - Alternative 5 Comparison to Existing Bridge

Bridge Widths - Alternative 5 vs Existing Bridge		
Description	**Alternative 5**	**Existing Bridge**
Total Bridge Width	76'-0"	57'-0"
Northbound Sidewalk Width	12'-0" (Multi-Use Path)	6'-0" Sidewalk
Travel Lane Width	11'-0"	10'-6"
Shoulder Widths	2'-0"	None Provided
Southbound Sidewalk Width	12'-0" (Multi-Use Path)	6'-0" Sidewalk
Number of Spans	2	3

Figure 23 - Alternative 5 Typical Bridge Section (Looking South)



The proposed abutments for Alternative 5 would be placed in the same location as the existing abutments. Maintaining the same location is preferred due to the following:

- Locating the proposed abutments behind the existing ones would require extensive utility relocation in the south (Burlington) approach roadway. This utility relocation would have substantial negative impacts to the maintenance of traffic in this intersection during construction.
- Locating the proposed abutments in front of the existing abutments would interfere with the pedestrian path underneath the bridge on the north (Winooski) approach. Utility relocations would

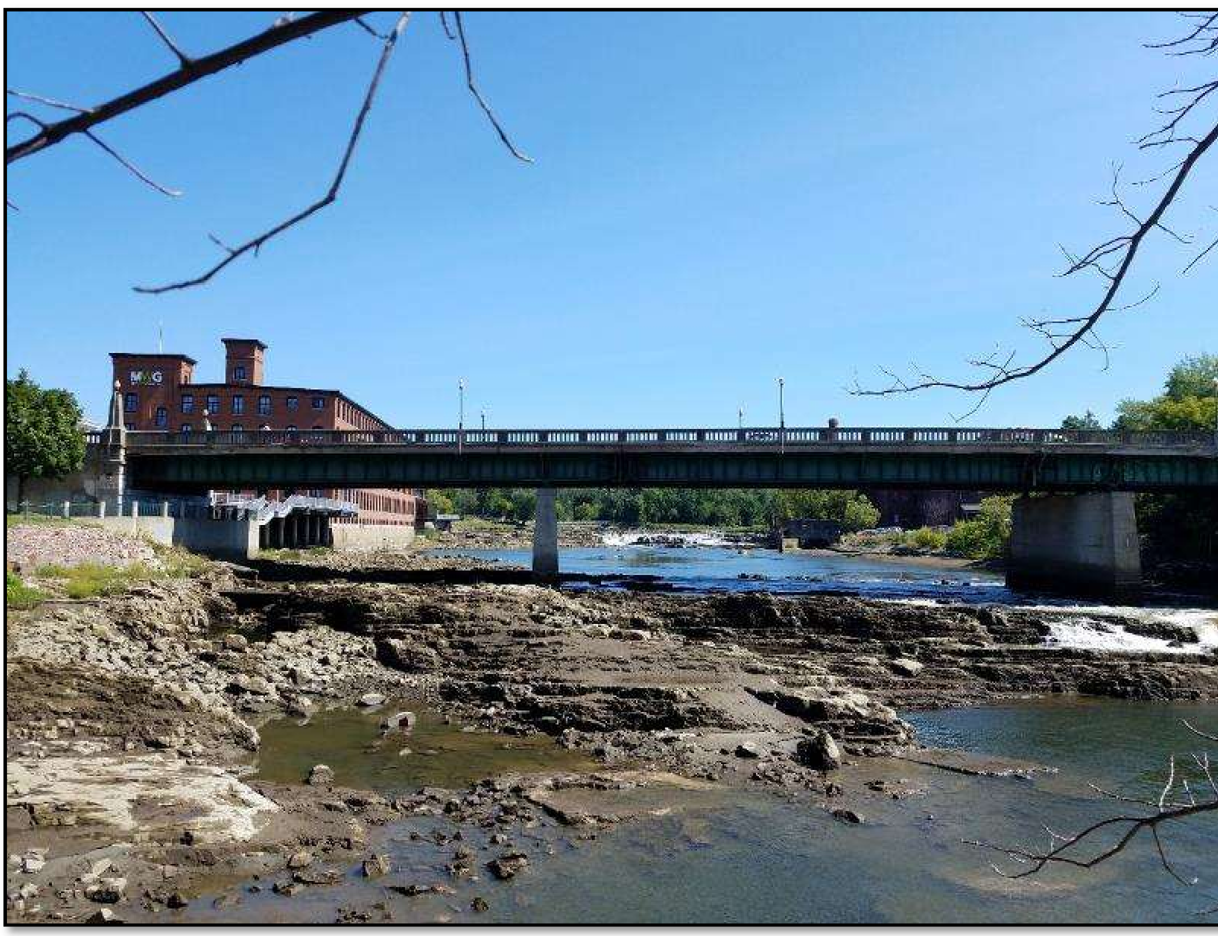
also be required at the south abutment due to the electric lines running underneath the bridge to the adjacent dam structure.

- Locating the new abutments in front of the existing abutments would negatively impact the floodway of the Winooski River.

A two-span replacement was chosen for Alternative 5 as it allows the new pier to be constructed between the existing piers. The new pier can be constructed under the existing structure prior to removing the existing bridge, which reduces impacts to traffic above and shortens the construction duration.

In addition, during the scoping process, the option of constructing the pier during a dam drawdown was discussed and evaluated. During a dam drawdown, the water level is low enough that de-watering for the construction of the proposed pier may not be required (See Figure 24 below). Constructing a pier during a drawdown could reduce the costs and associated impacts of temporary works required in the Winooski River. In addition, construction vehicles may be able to travel on the exposed ledge to access the location of the proposed pier. The existing piers can also be removed during a dam drawdown to potentially reduce the removal costs. As the development of this project progresses, additional coordination will be required with the dam operators to assess the feasibility of constructing portions of the bridge during a dam drawdown and how an extended dam drawdown would impact the operations and financial performance of the hydroelectric functions of the dam as well as potential impacts to fish passage.

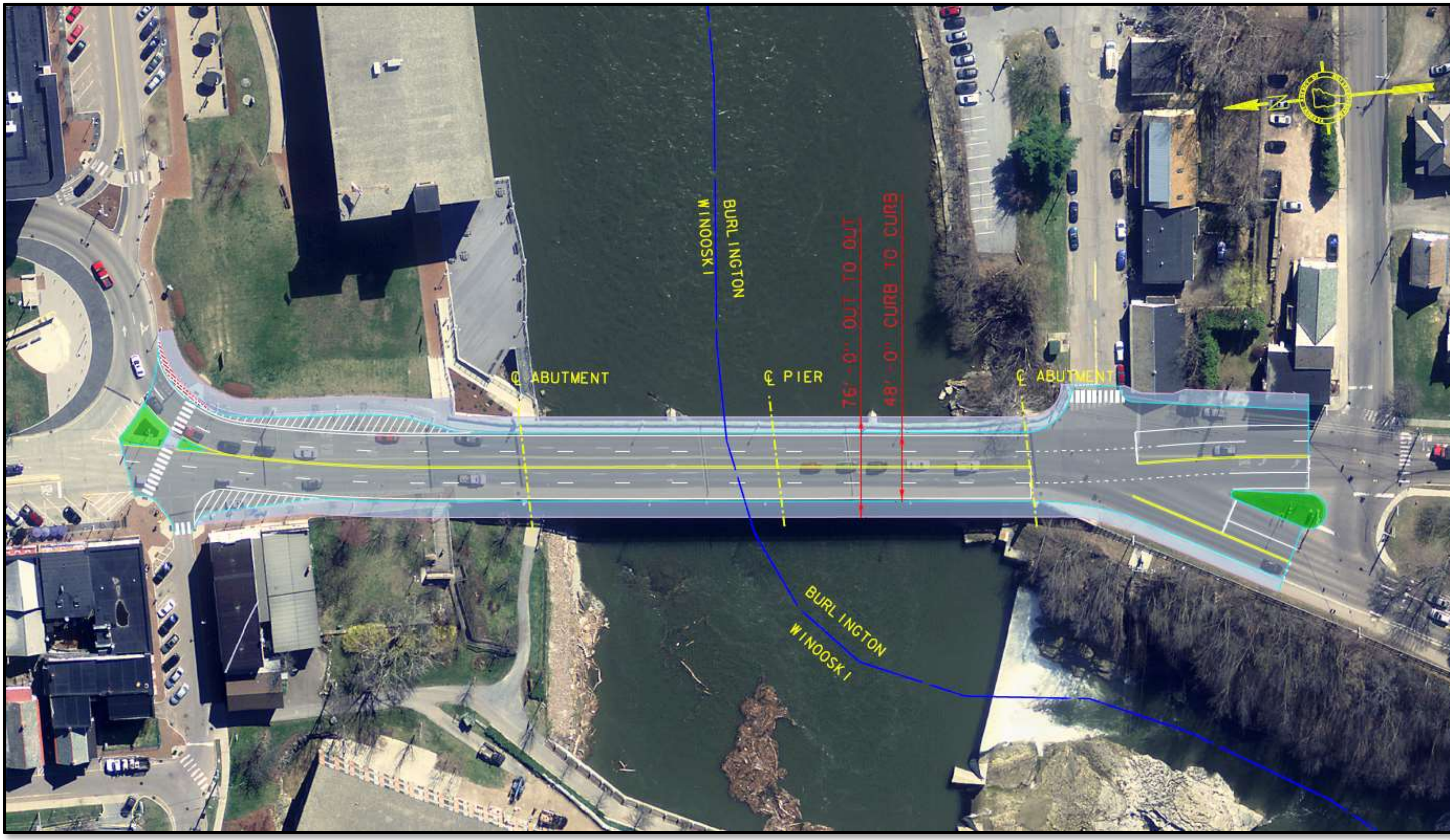
Figure 24 – Exposed Winooski River Ledge During Dam Drawdown



The use of ABC techniques would require complete closure of the bridge, which would have large traffic impacts to the surrounding communities. The duration of the bridge closure cannot be determined until final design; however, it is anticipated that a closure duration of 4-6 weeks would be required to remove the old bridge, slide the new bridge into place and reopen the structure to traffic. This is a major reduction in duration of traffic impacts when compared to the estimated construction duration of 2-3 years for conventional construction.

An additional benefit to constructing a new bridge will be the removal of a pier from the river. The piers are considered obstructions to the river channel and the removal of any obstruction from the river is considered a substantial improvement over the existing condition. In addition, the removal of a pier will slightly reduce the 100-year flood elevation compared to what is published by FEMA.

Figure 25 - Alternative 5 Plan View



VIII. ALTERNATIVES ANALYSIS SUMMARY

Each of the proposed alternatives were evaluated based on numerous criteria, particularly how well the requirements of the Purpose and Need statement were addressed. Alternatives 1-5 were evaluated, based on input from the CCRPC, the Advisory Committee, and a public information session, as well as with VTrans and Agency of Natural Resource staff. Each alternative was given a value ranking for each criterion and placed in an evaluation matrix for comparison with the other alternatives. This evaluation matrix is shown in Figure 27 and Figure 28 . A detailed description of selected evaluation criteria is provided in the following sections. The value ratings that were used are summarized below:

Highest Positive Value Rating

Slight Positive Value Rating

Neutral Value Rating

Slight Negative Value Rating

Lowest Negative Value Rating

In addition to the criteria noted in the Purpose and Need statement, traffic control during construction was expressed to be a major concern by the Advisory Committee and therefore included in the evaluation. A summary of the evaluation matrix is provided in Figure 26. A summary description of the primary evaluation criteria is provided below:

Improve Traffic Safety – Is safety for the motorists improved for each alternative?

Maintain/Improve Structural Integrity – Is the structural integrity of the bridge improved to meet the design life requirements for the next 100 years.

Improve Bike & Pedestrian Travel Connectivity – Is pedestrian connectivity on each side of the bridge improved for adjacent and future trails/sidewalks which are nearby to the bridge.

Minimize Resource Impacts – Are the impacts to natural and historic resources being avoided or are resources being disturbed due to the proposed alternative?

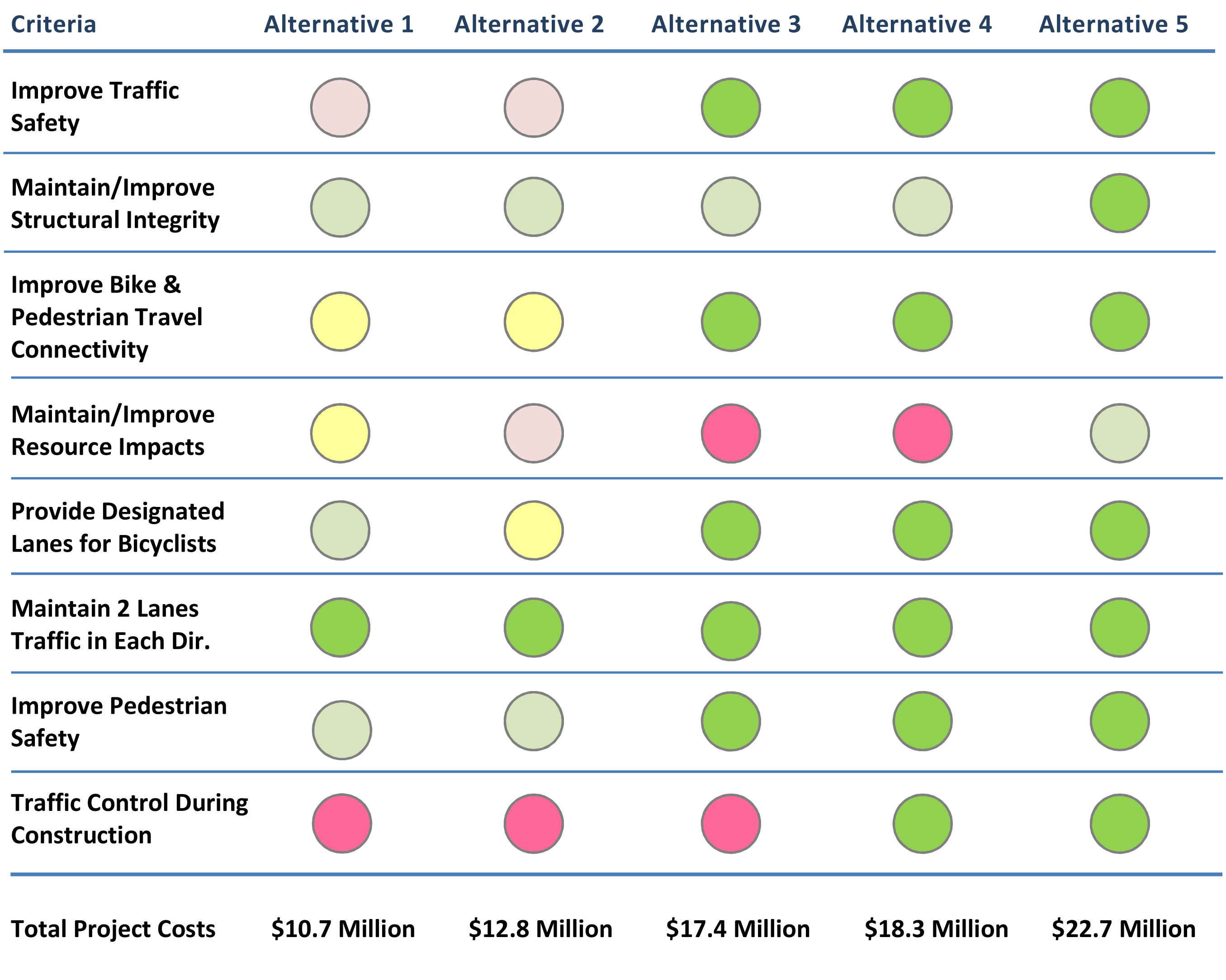
Provide Designated Lanes for Bicyclists – Are separate lanes provided for bicyclists in both directions?

Maintain Two Lanes of Traffic in Each Direction – Are two lanes in each direction provided in the final condition?

Improve Pedestrian Safety – Is safety of the pedestrians improved on each side of the bridge from the current condition?

Traffic Control During Construction – What are the impacts to vehicular traffic during construction?

Figure 26 - Evaluation Matrix Executive Summary



EVALUATION MATRIX

The criteria that were used to evaluate each alternative is summarized in a matrix and is presented in Figure 27 & Figure 28 below. A summary description of each criteria for each Alternative is presented in Appendix E.

Figure 27 - Evaluation Matrix

CHITTENDEN COUNTY REGIONAL PLANNING COMMISION
MAIN STREET (US ROUTES 2 & 7) OVER WINOOSKI RIVER – SCOPING REPORT STUDY
EVALUATION MATRIX

	Criteria	No Build	Alternative 1 Bridge Rehabilitation w/ Offline Ped Bridge	Alternative 2 Superstructure Replacement w/ Offline Ped Bridge	Alternative 3 Superstructure Replacement w/ Substructure Widening	Alternative 4 Superstructure Replacement w/ Substructure Widening (Possible ABC)	Alternative 5 Full Bridge Replacement w/ Two-Span Structure (Possible ABC)
PURPOSE & NEED	Improve Traffic Safety	No	Not Met (No Shoulder)	Not Met (No Shoulder)	Yes	Yes	Yes
	Maintain/Improve Structural Integrity	No	Minor Improvements	Yes	Yes	Yes	Yes
	Address Bridge Condition Deficiencies	No	Minor Improvements	Yes	Yes	Yes	Yes
	Improve Bike & Pedestrian Travel	No	Yes (On Separate Structure)	Yes (On Separate Structure)	Yes	Yes	Yes
	Maintain/Improve Resource Impacts	Yes	Minor Permanent Impacts	Minor Permanent Impacts	Minor Permanent Impacts	Minor Permanent Impacts	Yes
	Provide Designated Lanes for Bicyclists	No	Yes (On Separate Structure)	Yes (On Separate Structure)	Yes (On Bridge w/ Protected Path)	Yes (On Bridge w/ Protected Path)	Yes (On Bridge w/ Protected Path)
	Maintain 2 Lanes Traffic in Each Direction	Yes	Yes	Yes	Yes	Yes	Yes
	Improve Pedestrian Safety	No	Yes (On Separate Structure)	Yes (On Separate Structure)	Yes	Yes	Yes
COST	Bridge Cost	$0	$3,520,000	$4,380,000	$7,600,000	$8,270,000	$10,720,000
	Removal of Structure	$0	$810,000	$810,000	$810,000	$1,010,000	$1,310,000
	Roadway	$0	$200,000	$200,000	$200,000	$200,000	$200,000
	Temporary Works/Causeway	$0	$100,000	$350,000	$750,000	$750,000	$750,000
	Maintenance of Traffic	$0	$750,000	$1,000,000	$1,250,000	$960,000	$960,000
	Construction Costs	**$0**	**$5,380,000**	**$6,740,000**	**$10,610,000**	**$11,190,000**	**$13,940,000**
	Construction Engineering + Contingencies	$0	$1,620,000	$2,030,000	$3,720,000	$3,920,000	$4,880,000
	Total Construction Costs w/ CEC	**$0**	**$7,000,000**	**$8,770,000**	**$14,330,000**	**$15,110,000**	**$18,820,000**
	Preliminary Engineering	$0	$1,350,000	$1,690,000	$2,660,000	$2,800,000	$3,490,000
	Bike/Pedestrian Bridge (*Ref. D&K Report*)	$0	$1,900,000 (Average)	$1,900,000 (Average)	N/A	N/A	N/A
	Right of Way	$0	$30,000	$30,000	$50,000	$50,000	$50,000
	Public Participation	$0	$350,000	$350,000	$350,000	$300,000	$300,000
	Total Project Costs	**$0**	**$10,700,000 (Approx.)**	**$12,800,000 (Approx.)**	**$17,400,000 (Approx.)**	**$18,300,000 (Approx.)**	**$22,700,000 (Approx.)**
	Life-Cycle Cost ($/SF of Bridge Deck)	$0	$746	$734	$714	$746 w/ABC ($714 w/o ABC)	$883 (w/ABC)
SCHEDULING	Project Development Duration	N/A	TBD	TBD	TBD	TBD	TBD
	Bridge Closure Duration (If Applicable)	N/A	N/A	N/A	N/A	TBD (Weeks for ABC)	TBD (Weeks for ABC)
	Overall Project Construction Duration	N/A	2-3 Years	2-3 Years	2-3 Years	2-3 Years	2-3 Years
	Bridge Lane Reductions Required	N/A	Yes	Yes	Yes	No (With ABC)	No (With ABC)
	Bridge Closure Required	N/A	No	No	No	Possible (with ABC)	Possible (with ABC)

Figure 28 - Evaluation Matrix (Continued)

	Criteria	No Build	Alternative 1 Bridge Rehabilitation w/ Offline Ped Bridge	Alternative 2 Superstructure Replacement w/ Offline Ped Bridge	Alternative 3 Superstructure Replacement w/ Substructure Widening	Alternative 4 Superstructure Replacement w/ Substructure Widening (Possible ABC)	Alternative 5 Full Bridge Replacement w/ Two-Span Structure (Possible ABC)
ROADWAY & PEDESTRIAN IMPACTS	Typical Section - Bridge & Roadway	4 – 10'-6" Lanes (42' Roadway Width)	4 – 10'-6" Lanes (42' Roadway Width)	4 – 10'-6" Lanes (42' Roadway Width)	4 – 11' Lanes with 2 – 2' Shoulders (48' Roadway Width)	4 – 11' Lanes with 2 – 2' Shoulders (48' Roadway Width)	4 – 11' Lanes with 2 – 2' Shoulders (48' Roadway Width)
	Roadway Geometric Design Criteria	Not Met (No Shoulder)	Not Met (No Shoulder)	Not Met (No Shoulder)	Meets Current Roadway Criteria	Meets Current Roadway Criteria	Meets Current Roadway Criteria
	Traffic Safety	No Change	No Change	Small Improvement (If Sidewalk Removed on 1 Side of Bridge)	Improvement	Improvement	Improvement
	Roadway Alignment Change	No	No	No	Horizontal Shift East	Horizontal Shift West	Horizontal Shift West
	Accommodates Colchester/Riverside Intersection Reconstruction	Yes	Yes	Yes	Yes	Yes	Yes
	Bicycle Access	No Change	Yes (On Separate Pedestrian Bridge)	Yes (On Separate Pedestrian Bridge)	Yes (One Bridge)	Yes (One Bridge)	Yes (One Bridge)
	Bike Lane Width (on Bridge)	N/A	N/A	5' (On One Side of Bridge Only)	12' (Approximate)	12' (Approximate)	12' (Approximate)
	Pedestrian Access	No Change	No Change (On Bridge)	No Change (On Bridge)	Large Improvement	Large Improvement	Large Improvement
LIFE CYCLE ANALYSIS	Design Life/ Expected Longevity	10-15 Years	50 Years	100 Years (Superstructure) 50-75 Years (Abutments & Pier)	100 Years (Superstructure Only) 50-75 Years (Abutments & Pier)	100 Years (Superstructure Only) 50-75 Years (Abutments & Pier)	100 Years (Entire Structure)
	Expected Long Term Repair Costs	N/A	High	Moderate	Moderate	Moderate	Low
	Future Abutment/Pier Rehab Requirement	High	High	Moderate	Moderate	Moderate	Low
RESOURCE IMPACTS & PERMITTING REQUIREMENTS (See Note 1)	Future River Access Requirements	N/A	Moderate	High	High	High	Low
	Farmland Soils	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
	Wetlands & Surface Waters	No Impact	No Impact	No Impact	Minor Permanent Impact	Minor Permanent Impact	Minor Permanent Impact
	Floodplains & Floodways	No Impact	No Impact	No Impact	Minor Permanent Impact	Minor Permanent Impact	Minor Permanent Impact
	Hazardous Material Sites	No Impact	Possible Impact	Possible Impact	Possible Impact	Possible Impact	Possible Impact
	Habitat Blocks & Wildlife Corridors	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
	Rare, Threatened & Endangered Species	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
	Conservation & Recreation Lands	No Impact	Possible Temporary Impact	Possible Temporary Impact	Possible Temporary Impact	Possible Temporary Impact	Possible Temporary Impact
	Historic/Archaeological Resource Impacts	No Impact	Mitigation Required	Mitigation Required	Mitigation Required	Mitigation Required	Mitigation Required
OTHER	Utility Impacts	No Change	No Change	Temp. Relocation Required	Relocation Required	Relocation Required	Relocation Required
	Hydraulic Performance	No Change - Adequate	No Change - Adequate	No Change - Adequate	No Change - Adequate	No Change - Adequate	Improvement
	ROW Acquisition	N/A	Yes	Yes	Yes	Yes	Yes
	Seismic Vulnerability	Low	Low	Lower	Lower	Lower	Lowest

Notes

1. Impacts due to separate bike/pedestrian bridge *are not* included in the impacts and permitting requirements

Key

- Lowest Negative Value Rating
- Slight Negative Value Rating
- Neutral Value Rating
- Slight Positive Value Rating
- Highest Positive Value Rating

IX. COST SUMMARY

PROJECT COST SUMMARY

A summary of the project cost estimates has been developed and is provided in **Table 7** below. Costs have been developed based on recent Vermont weighted average unit prices and bid results from recently constructed projects. A complete breakdown of the cost estimates for each alternative is provided in Appendix C.

Table 7 – Summary of Project Costs

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Construction Costs	$5,380,000	$6,740,000	$10,610,000	$11,900,000	$13,940,000
Construction Engineering & Contingencies	$1,620,000	$2,030,000	$3,720,000	$3,920,000	$4,880,000
Prelim Engineering	$1,350,000	$1,690,000	$2,660,000	$2,800,000	$3,490,000
Ped/Bike Bridge	$1,900,000 (Average)	$1,900,000 (Average)	N/A	N/A	N/A
Right-of-Way	$30,000	$30,000	$50,000	$50,000	$50,000
Public Participation	$350,000	$350,000	$350,000	$300,000	$300,000
Total Project Costs (Approx.)	**$10,700,000**	**$12,800,000**	**$17,400,000**	**$18,300,000**	**$22,700,000**

LIFE CYCLE COST ESTIMATES

A Life cycle cost analysis is an economic analysis tool which is useful in comparing the relative merit of competing project alternatives. Total project costs are assumed over the expected life of the project (100-year design life for this project) for each alternative, and then compared to see what the total expected cost over the life of the structure is. Costs were developed for all alternatives based on FHWA guidelines for a life-cycle cost analysis. All costs were developed on a conceptual level, however the following general assumptions were made regarding the life cycle cost analysis:

- Present worth (2018 dollars) are calculated.
- 4% inflation rate is used per year.

- A 100-year life cycle analysis was used
- Costs are shown in dollars per square foot of proposed bridge area due to the various sizes of the proposed bridges.
- Roadway user costs are not included in the life cycle analysis
- A 50-year remaining service life is assumed for Alternative 1.
- There will be no residual value for any alternative after 100 years.

A summary of the life cycle cost for each alternative is provided in Table 8 below:

Table 8 - Life Cycle Cost Summary

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Life Cycle Cost ($/SF of Bridge Deck)	**$752**	**$734**	**$698**	**$730 (w/ABC)** **$698 (w/o ABC)**	**$871 (w/ABC)**

It is important to note that with a life-cycle cost analysis, it is typical for the cost of future rehabilitation items (required for Alternatives 1-4), which are deferred to future years, to be shown as being more cost effective than a structure replacement with minimal future rehabilitations. However, these costs do not consider unanticipated emergency repairs due to the age of the structure, the risk of deferring project costs, site constraint changes and roadway user costs. A more detailed breakdown of the life-cycle user costs is provided in Appendix D.

X. PUBLIC & ADVISORY COMMITTEE INPUT

PUBLIC CONCERNS MEETING SUMMARY

A public concerns meeting was held on February 6, 2018 to review the alternatives developed, gather public input regarding the alternatives, and to choose a preferred alternative. Only Alternatives 1 through 4 were discussed at the Public Concerns Meeting. Alternative 5 was developed and reviewed after the local Public Concerns Meeting, and therefore was not included in the discussion. A summary of the public concerns is provided below:

- Impacts to nearby residences and businesses should be minimized as much as possible
- Environmental impacts to the Winooski River should be minimized as much as possible and mitigated as required.
- Mill Street access should be maintained during construction, and parking along Mill Street and in the Mill Street parking lot should be maintained as much as possible.
- How will this project connect into existing travel ways and proposed roadway improvement projects in the nearby vicinity?
- Traffic impacts should be minimized as much as possible.
- A short duration full bridge closure is more favorable than years of reduced lanes and traffic shifts with phased construction.
- Traffic plans, well signed detour routes and public shuttles should be established in advance of the closure.

- A public outreach plan should be made to reach out to local businesses and residents prior to the bridge closure.
- The projects should connect to the existing multi-use path on Riverside Avenue.

After the formal discussion, the public was asked to provide their vote as to the preferred alternative. **Alternative 4 was the unanimous choice of the 18 attendees who voted**.

PUBLIC CONCERNS MEETING CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations were established from the Public Concerns meeting:

- **Alternative 4 with accelerated bridge construction is the preferred alternative** and method of construction.
- Local residences, businesses and commuters should be kept informed through all phases of the project through a dedicated public input official and process.
- A shuttle or other means of connecting local bicyclists and pedestrians should be established during the closure period.
- The portion of the new bridge constructed prior to demolition of the existing bridge should be wide enough for emergency vehicle access.

ADVISORY COMMITTEE RECOMMENDATIONS

On July 12th and August 9th, the Advisory Committee met to provide input and recommendations as to a preferred alternative based on the evaluation matrix developed and summarized in Figure 27 and Figure 28 of this report. **Following considerable discussion, the Advisory Committee unanimously selected both Alternatives 4 and 5 to move forward as locally recommended alternatives and that the bridge should be constructed using an accelerated bridge construction approach.** The decision to recommend both Alternatives 4 and 5 was based on two basic factors:

1) The roadway configuration (vehicle lanes and bicycle & pedestrian facilities) is identical for both Alternatives 4 and 5 (reference Figure 19 & Figure 23).

2) Making a recommendation on the structural design of the bridge was not possible or prudent at this point due to:

- Unknown factors regarding the condition of the existing substructure (piers and abutments) which will be determined during future phases of the project design process.
- Unknown future Winooski River access constraints from either the Winooski or the Burlington side which could significantly impact construction methods.
- Unknown timeframe of project construction.

Due to these unknown factors, the construction estimates provided in the evaluation matrix may change as more information becomes available during the design phase of the project. More consultation will take place with the communities and elected officials of both Winooski and Burlington when this project progresses into the design phase.

XI. APPENDICES